# Pretty Lake Aquatic Plant Management Plan 2007-2011
**Lagrange County, Indiana**

**22 February 2008**

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**PRETTY LAKE AQUATIC PLANT MANAGEMENT PLAN 2007-2011**
**LAGRANGE COUNTY, INDIANA**

## EXECUTIVE SUMMARY


This document is intended to describe the aquatic plant community present in Pretty Lake during the spring and summer 2007 assessments. Additionally, the plan details options for addressing individual resident's concerns regarding aquatic plants within Pretty Lake and documents the selected treatment actions for the next five years. It is anticipated that this plan will serve as a baseline for aquatic plant management efforts at Pretty Lake and that subsequent surveys and treatment strategies will update the data collected during these assessments.

Tier II and exotic species surveys were conducted in the spring (May 15-June 15) and summer (July 15-August 30) to document the Pretty Lake aquatic plant community. Pretty Lake contains a very diverse aquatic plant community home to more than seventy emergent, submerged, and floating species. Nearly one-quarter of the aquatic plant diversity can be attributed to submerged species. Additionally, a majority of the submerged species are members of the pondweed family. These species along with several state rare and other high quality species comprise Pretty Lake's aquatic plant community.

During both the spring and summer surveys, muskgrass (*Chara* species) dominated the aquatic plant community. Nitella, sago pondweed, coontail, and grassy pondweed were present at more than 20% of the sampled sites during the spring, while nitella, sago pondweed, spiny naiad, eel grass, and coontail were present at more than 20% of the sampled sites during the summer survey. Eurasian watermilfoil was present at 11.8% of the sampled sites during the spring survey and 15.3% of the sampled sites during the summer survey, while curly-leaf pondweed occurred at 5.1% of the sampled sites during the spring and was not identified during the summer. In comparing 2007 spring and summer Tier II survey data, it was found that the relative density and abundance of Eurasian watermilfoil increased and curly-leaf pondweed decreased throughout the lake.

Additional items including a public meeting, and a meeting between the contractor, LARE program staff, the district fisheries biologist, and a representative from the Pretty Lake Conservation Club (PLCC), also occurred in concert with this aquatic plant management plan update. The details of these are not repeated here, but were utilized to generate recommendations as follows:

1. Early season assessment of curly-leaf pondweed populations (approximately 5 acres) to determine if treatment is necessary. Assessment and treatment should occur when water temperatures are at 30 to $40^{o}$ C.
2. Treatment of approximately 15 acres of Eurasian watermilfoil throughout Pretty Lake. Areas are identified in the following sections, but should be confirmed prior to treatment occurring in 2008.
3. Continue pre- and post-treatment assessments to determine how the aquatic plant community within Pretty Lake changes over time.

However, based on the decisions of the PLCC board of directors, the PLCC will forego aquatic plant management activities at this time in favor of addressing watershed projects to protect and improve the water quality within Pretty Lake.

Estimated costs for 2008 assessment and treatment are as follows:

- Early season curly-leaf pondweed assessment and treatment. Assessment will cost approximately $1,625. Based on the 2007 survey, it is anticipated that 5 acres of curly-leaf pondweed treatment with Aquathol K will be necessary. Final cost estimates will be developed based on the area to be treated and the chemical to be utilized.
- Eurasian watermilfoil treatment: maximum total cost of $6,000.
- Assessment and plan updates costs are based on 2007 requirements and are estimated to total $6,955.
- Total fees for 2008 aquatic plant assessment, herbicide application, and plan updated are estimated at $14,580.

## ACKNOWLEDGEMENTS

The Indiana Department of Natural Resources Division of Fish & Wildlife as part of the Lake and River Enhancement Program (LARE) provided funding for the development of this plan. The plan has been developed in cooperation with the Pretty Lake Conservation Club. Fieldwork, data analysis, and map generation was performed by JFNew with the assistance of the Pretty Lake Conservation Club volunteers. Special thanks to Jim Mertz for his assistance and boat driving abilities and to Neil Ledet, Larry Koza, Gwen White, and Angela Sturdevant for their insight and input. Contributors include: Sara Peel, Betsy Ewoldt, and Scott Namestnik.

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## 1.0 Introduction

Pretty Lake is a 184-acre (74.5-ha) natural lake that lies in southeast corner of Lagrange County, Indiana (Figure 1). Specifically, the lake is located in Sections 15 and 16 of Township 36 North, Range 11 East in Lagrange County. The Pretty Lake watershed stretches out to the north and west of the lake encompassing approximately 1,230 acres (497.7 ha or 1.9 square miles; Figure 2). Water discharges through the lake's outlet in the northeast corner. Water from Pretty Lake's outlet combines with water from Mud Lake to flow north into Little Turkey Lake. Water from Little Turkey Lake exits through Turkey Creek flowing north to empty into the Pigeon River near Mongo, Indiana. The Pigeon River transports water to the St. Joseph River, which eventually discharges into Lake Michigan.

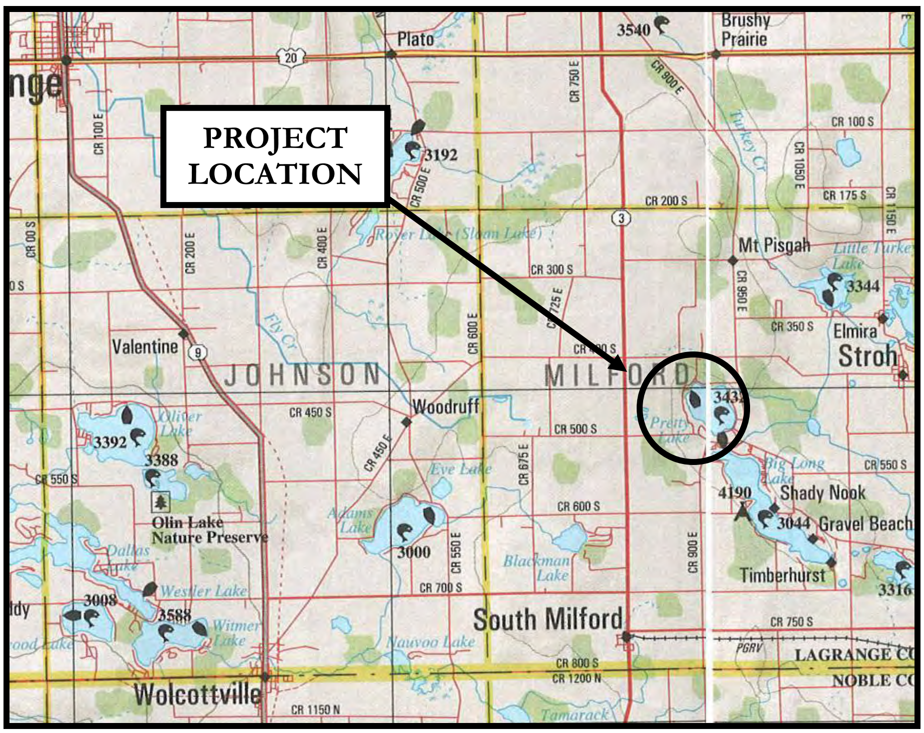



**Figure 1. General location of the Pretty Lake watershed.** Source: DeLorme, 1998.

Despite the lake's excellent water quality and its ability to provide good fishing, lake residents, particularly long-time residents, have noticed changes in the lake over the past several years. Residents have observed a shift in the type of vegetation in the lake. Specifically, emergent vegetation beds have decreased in size, while more nuisance vegetation, including Eurasian watermilfoil, appears to have expanded its coverage in the lake. Residents have also noted a decrease in the lake's water clarity in some portions of the lake following large rain events. These changes have negatively impacted the residents' enjoyment of the lake and increased their desire to protect the lake's health and future. In 2006, JFNew documented excellent water quality within Pretty Lake (JFNew, 2007). During completion of the diagnostic study, JFNew identified nearly 75 aquatic plants representing all three strata (submerged, emergent, and floating) within Pretty Lake. Nonetheless, Pretty Lake residents expressed concern over the presence of exotic, invasive aquatic plant species including Eurasian watermilfoil, curly-leaf pondweed, purple loosestrife, and reed canary grass. Additionally, residents noted their desire for Pretty Lake to maintain its diverse aquatic plant community, to restore emergent plant beds that were historically present within the lake, and to control the spread of exotic, invasive species.

This report serves as a baseline for management efforts of Pretty Lake's aquatic plant community. The plan will serve as a tool by which the DNR can track future changes in the vegetation community, provide a baseline plan of action for controlling exotic species and improving the diversity of native species within the lake, and to maintain eligibility for additional LARE funds through the aquatic plant management program. Items covered include a review of spring and summer Tier II results from the 2007 season; details of exotic and high quality aquatic plant species and their locations; a recap from the public meeting; a management plan for future aquatic plant management efforts; and a discussion of potential management implications. The plan was funded by the Indiana Department of Natural Resources (IDNR) Lake and River Enhancement Program (LARE) and the Pretty Lake Conservation Club (PLCC). This is the first year that that Pretty Lake has been involved in aquatic plant management planning through the LARE program.

During the 2007 growing season the following actions were taken.

- May 30, 2007; Tier II aquatic plant survey and exotic species survey completed.
- July 30, 2007; Tier II and exotic species aquatic plant surveys completed.
- September 1, 2007; Public meeting to discuss initial aquatic plant survey results and treatment.
- November 9, 2007; Meeting between the PLCC, JFNew, Weed Patrol Inc., and IDNR to discuss 2008 treatment options

# 2.0 Watershed and Lake Characteristics

## 2.1 Watershed Characteristics

Pretty Lake is a headwaters lake in the Great Lakes Basin. Surface water drains to Pretty Lake via three primary routes: through Deal Ditch, through an unnamed tributary which enters near the public access site, and via direct drainage. Deal Ditch drains approximately 651 acres (263.5 ha or 53%) of the watershed north of Pretty Lake (Table 1). This stream empties into Pretty Lake in the lake's northeast corner. The drain was originally constructed as a tile drain in 1902 and was subsequently reconstructed in 1952 as an open drain (Rex Pranger, personal communication). This drain is a legal drain, which means that the drain is maintained by the drainage board. Furthermore, any activity in and around the drain must be approved by the drainage board prior to the activity occurring. An unnamed tributary transports water to Pretty Lake from the watershed west of the lake emptying into the lake along its western boundary. In total, this tributary drains 160 acres (64.7 ha) of the Pretty Lake watershed. The remaining 19% of the land in the Pretty Lake watershed (236 acres or 95.5 ha) drains directly to Pretty Lake or via a series of small swales along the lake's western shoreline. Figure 2 illustrates the boundaries of each of these subwatersheds of Pretty Lake. McGinty (1966) noted that the main inlet to Pretty Lake (Deal Ditch) supplied 80% of the surface water to the lake. However, it should be noted that a majority of water likely enters Pretty Lake as groundwater. Historic fluctuations in surface water level typically occurred due to a large spring associated with the lake (McGinty, 1966).

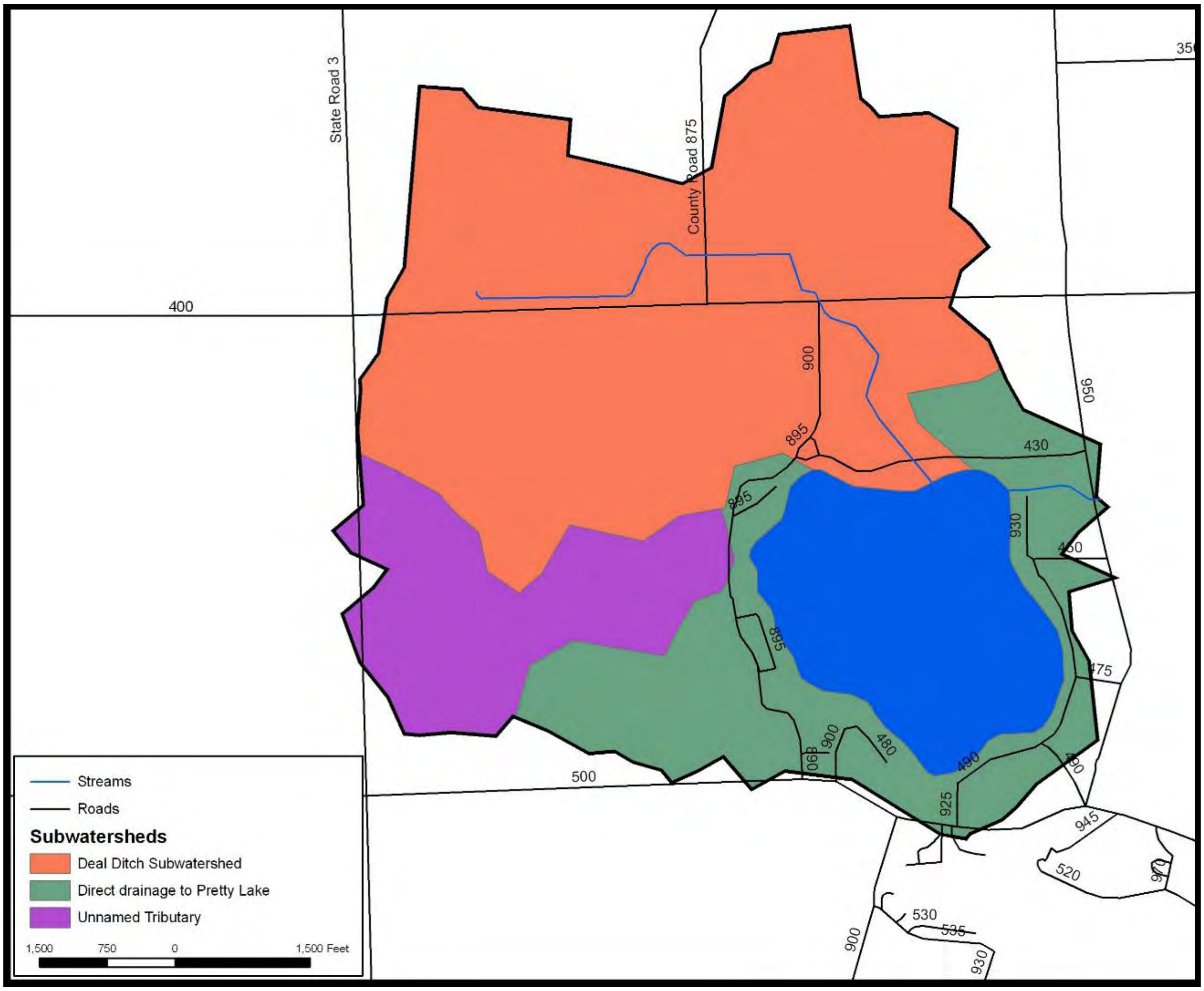



**Figure 2. Pretty Lake subwatersheds.**

### 2.1.1 Soils

The Wawasee-Hillsdale-Conover soil association covers the entirety of the Pretty Lake watershed. The Wawasee-Hillsdale-Conover soil association is the most plentiful association covering 34% of Lagrange County. Soils in this soil association developed from glacial till and occur on till plains and moraines. Thirty percent of the soil association consists of Wawasee soils, while Hillsdale soils cover 17% and Conover soils cover 14%. Wawasee soils are well drained and occur on knobs and breaks between drainageways. Hillsdale soils are also well drained soils; however, they are typically found on ridges between drainageways and on level till plains. Conover soils are typically located on broad flats or along drainageways and are somewhat poorly drained. Boyer loamy sand, Oshtemo loamy sand, Chelsea fine sand, Metea loamy sand, and Martinsville sandy loam soils are minor components of this association. Whitaker soils are common on low areas in the landscape, while Rensselaer soils are located in depressions and drainageways and Houghton soils are found in low-lying pockets and deep depressions.

Soils that erode from the landscape are transported to waterways where they degrade water quality, interfere with recreational uses, and impair aquatic habitat and health. Highly erodible and potentially highly erodible are classifications used by the Natural Resources Conservation Service (NRCS) to describe the potential of certain soil units to erode from the landscape. The NRCS examines common soil characteristics such as slope and soil texture when classifying soils. Erodible soils located on the most steeply sloped areas (HES) cover approximately 99 acres (40.1 ha) or 8% of the Pretty Lake watershed, while erodible soils on steep-slopes (PHES) cover approximately 450 acres (182.1 ha) or 36% of the watershed. Highly erodible and potentially highly erodible soils border nearly the entire shoreline of Pretty Lake and cover much of the watershed lying directly north and west of the lake.

### 2.1.2 Land Use

Figure 3 and Table 1 present current land use information for the Pretty Lake watershed. Like many Indiana watersheds, agricultural land use dominates the Pretty Lake watershed, accounting for approximately 67% of the watershed. Row crop agriculture makes up the greatest percentage of agricultural land use at 50.2%, while pastures or hay vegetate another 16.8%. Land uses other than agriculture account for the remaining 33% of the watershed. Natural landscapes, including forests and wetland, cover approximately 17% of the watershed. Most of the natural acreage in the watershed is associated with the forested and emergent and woody wetland area north of Pretty Lake. Additional smaller tracts are located near the headwaters of Deal Ditch, in the northeastern corner of the watershed, and adjacent to the pond in the watershed's southwestern corner. These natural areas consist of small tracts of wooded or emergent wetlands or deciduous forest, and are scattered along the shoreline. Open water, including Pretty Lake and several small ponds, accounts for another 15% of the watershed. Most of the remaining 1.3% of the watershed is occupied by low intensity residential land, with less than 1% of high intensity residential or commercial land. Much of the residential land lies directly adjacent to Pretty Lake.

**Table 1. Detailed land use in the Pretty Lake watershed.**

| Land Use | Area (acres) | Area (hectares) | % of Watershed |
|---|---|---|---|
| Row Crops | 618.1 | 250.3 | 50.2% |
| Pasture/Hay | 207.0 | 83.8 | 16.8% |
| Open Water | 187.2 | 75.8 | 15.2% |
| Deciduous Forest | 155.5 | 63.0 | 12.6% |
| Woody Wetlands | 37.6 | 15.2 | 3.1% |
| Low Intensity Residential | 14.7 | 6.0 | 1.2% |
| Emergent Herbaceous Wetlands | 8.3 | 3.4 | 0.7% |
| Evergreen Forest | 1.1 | 0.4 | 0.1% |
| High Intensity Commercial | 0.9 | 0.4 | 0.1% |
| High Intensity Residential | 0.7 | 0.3 | 0.1% |
| Mixed Forest | 0.2 | 0.1 | <0.1% |
| **Entire Watershed** | **1,231.3** | **498.5** | **100.0%** |

Source: USGS EROS, 1998.

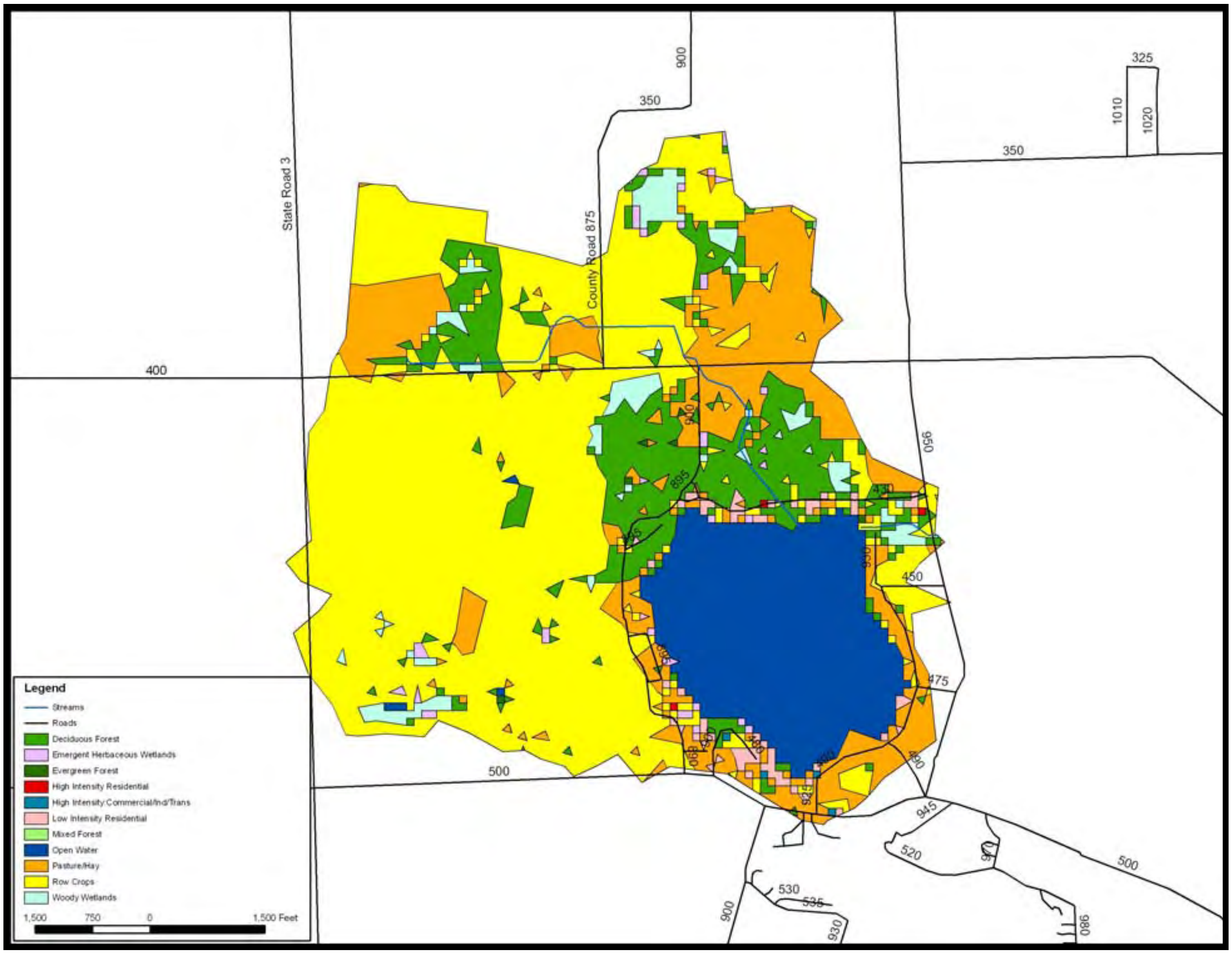



**Figure 3. Land use in the Pretty Lake watershed.**
Source: USGS EROS, 1998.

## 2.2 Lake Characteristics

### 2.2.1 Morphology

Figure 4 presents Pretty Lake's moderately complex morphology. The lake consists of two deep holes surrounded by shallower water. The lake's deepest point lies slightly west of the center of the 184-acre (34-ha) lake. Here, the lake extends to its maximum depth of 82 feet (25 m; Table 2). One shallower hole lies in the southeastern portion of the lake reaching a maximum depth of 50 feet (15.2 m). Water as shallow as 30 feet (9.1 m) separates these holes from the other parts of the lake. The lake also contains two shallow areas (shoal), one along the western shoreline north of the public access site (3 feet or 0.9 m) and one in the northeast corner of the lake which is commonly known as Job's Hole (4 feet or 1.2 m)

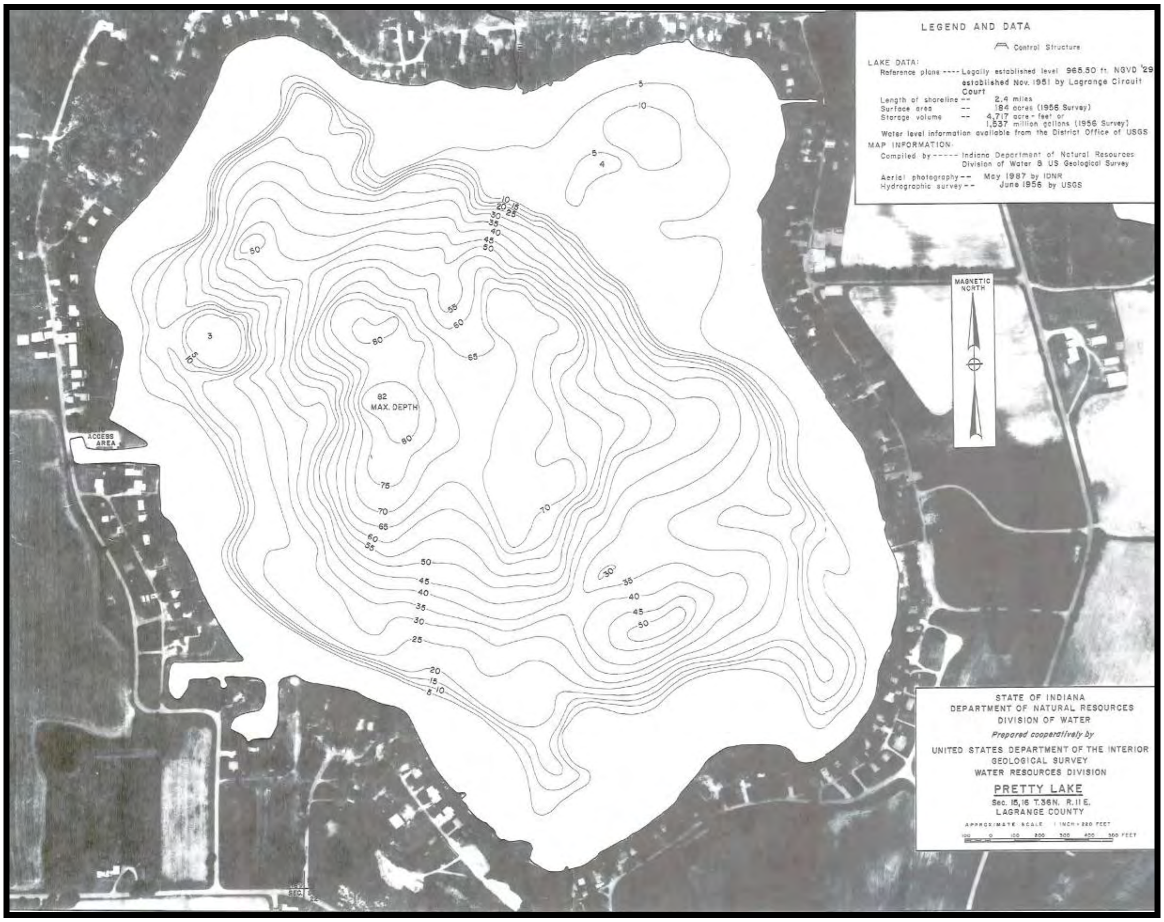



**Figure 4. Pretty Lake bathymetric map.** Source: IDNR, 1956.

**Table 2. Morphological characteristics of Pretty Lake.**

| Characteristic | Value |
|---|---|
| Surface Area | 184 acres (34 ha) |
| Volume | 4,717 acre-feet (5,818,178 $m^3$) |
| Maximum Depth | 82 feet (25 m) |
| Mean Depth | 25.6 feet (7.8 m) |
| Shallowness Ratio | 0.32 |
| Shoalness Ratio | 0.48 |
| Shoreline Length | 13,472 feet (4,106 m) |
| Shoreline Development Ratio | 1.34 |

Pretty Lake possesses limited expanses of shallow water. According to its depth-area curve (JFNew, 2006), nearly 60 acres (24.3 ha) of the lake is covered by water less than 5 feet (1.5 m) deep, while nearly 92 acres (37 ha) is covered by water less than 20 feet (6.1 m) deep. This translates into a very low shallowness ratio of 0.32 (ratio of area less than 5 feet (1.5 m) deep to total lake area) and a moderately high shoalness ratio of 0.48 (ratio of area less than 20 feet (6.1 m) deep to total lake area) (Table 2), as defined by Wagner (1990). A large portion of the lake's acreage (approximately 46 acres or 32.5 ha) covers the water deeper than 40 feet (12.1 m). The lake's area gradually increases with depth to a water depth of about 10 feet (3 m) before the rate of change increases. This rate (slope of lake bottom) continues to the lakes maximum depth (82 feet or 25 m).

Pretty Lake holds approximately 4,717 acre-feet (5,818,178 $m^3$) of water. As illustrated in the depth-volume curve (JFNew, 2007), most of the lake's volume is contained in the shallower areas of the lake. More than 75% of the lake's volume is contained in water that is less than 35 feet (10.7 m) deep. The lake's volume gradually increases with depth to a water depth of about 50 feet (15.2 m) before the rate of change increases. Below 50 feet (15.2 m), the steep curve indicates a greater change in depth per unit volume. This rate continues to the lakes maximum depth (82 feet or 25 m).

A lake's morphology can play a role in shaping the lake's biotic communities. For example, Pretty Lake's moderately sized shallow area and wide, shallow shelf around much of the perimeter of the lake coupled with its good water clarity suggests that the lake is capable of supporting a quality rooted plant community. Based on the lake's clarity, Pretty Lake's littoral zone (or the zone capable of supporting aquatic rooted plants) extends from the shoreline to the point where water depths are approximately 35.5 feet (10.8 m). Referring to Pretty Lake's depth-area curve, this means that the lake's littoral zone is approximately 130 acres (52.6 ha) in size or approximately 70% of the lake. The lake's 1% light level (or the depth at which only 1% of available surface light penetrates) is less than the littoral zone calculated by multiplying the transparency by a factor of three. Using the second method, Pretty Lake's littoral zone reaches a depth of 23 feet (7 m) and covers 101 acres (40.9 h) or 55% of the lakes surface area. This size littoral zone can impact other biotic communities in the lake such as fish that use the plant community for forage, spawning, cover, and resting habitat.

### 2.2.2 Shoreline Development

Development around Pretty Lake began early, and by 1938, approximately 60 cottages were located along Pretty Lake's shoreline (Grant, 1989). Most of the houses were scattered around the lake with the exception of the western shoreline, which remained largely undeveloped. Over the next 25 years, development around the shores of Pretty Lake increased. In 1964, McGinty noted the presence of 159 cottages and 3 trailers. Individual residents owned 226 boats and 18 pontoons, many of which were housed at 4 boat liveries. By 1965, nearly the entire shoreline was developed. Cottages and trailer courts ringed much of Pretty Lake. The wetland buffers that were previously present adjacent to Pretty Lake were filled and developed (Grant, 1989). By the 1970s, development covered similar areas as those observed in 1964. Residential and boat densities remained the same as determined by Peterson (1974) who noted 153 homes and 245 boats present along 95% of the shoreline in 1973. Aerial photographs from 1972 confirm the presence of houses scattered along nearly the entire shoreline of Pretty Lake with these houses present in similar densities to those present in both the 1930s and today.

Given the plethora of houses along Pretty Lake's shoreline, it is not surprising that nearly 92% of Pretty Lake's shoreline has been altered in some form. Along much of Pretty Lake's shoreline (64%; 8,735 feet or 2,662 m), trees and emergent vegetation have been thinned; however, these areas possess at least a narrow band of emergent plants (Figure 5). These areas are mapped as modified natural shoreline because they still possess at least a small portion of all these strata (submerged, emergent, and floating). Other portions of the shoreline that are also mapped as modified natural include those areas where individuals removed only the portion of the shoreline vegetation required to view or access the lake. Photographs of all of these shoreline types were identified during completion of the Pretty Lake Diagnostic Study (JFNew, 2007).


**Figure 5. Shoreline surface type observed at Pretty Lake, July 30, 2007.**

Approximately 26% of Pretty Lake's shoreline has been largely altered from its natural state (Figure 5). Along these portions of Pretty Lake's shoreline, emergent and floating rooted vegetation has been completely removed from areas adjacent to the shoreline. This leaves bare soils or mowed, residential lawns exposed to wave action. In some areas, wooden railroad timbers, concrete seawalls, glacial stone, or riprap cover the shoreline. This type of shoreline is especially prevalent in the lake's northeastern corner where wind and wave energy is higher than other areas of the lake. This area of the lake is subject to higher wave energy due to prevailing winds and possessing the highest ***fetch*** (longest distance that the wind travels without touching land) of anywhere on the lake.

Natural shoreline remains along approximately 8% of Pretty Lake's shoreline where bands of plants like those described by McGinty (1966) are present with trees, emergent vegetation, floating vegetation, and submerged vegetation located in distinct zones along the lakeshore (Figure 5). In these areas, the submerged, floating, emergent, and shoreline canopy layers all remain intact.

The shoreline surface becomes especially important in and adjacent to shallow portions of Pretty Lake. In areas where concrete seawalls are present, wave energy from wind and boats strike the flat surface and reflect back into the lake. This creates an almost continuous turbulence in the shallow areas of the lake. At points where the waves reflect back into the lake and meet incoming waves, the wave height increases resulting in additional in-lake turbulence. This turbulence re-suspends bottom sediments thereby increasing the transfer of nutrients from the sediment-water interface to the water column. Continuous disturbance in shallow areas can also encourage the growth of disturbance-oriented plants.

In contrast, shorelines vegetated with emergent or rooted floating vegetation or those areas covered by sand will absorb more of the wave energy created by wind or boats. In these locations, wave energy will dissipate along the shoreline each time a wave meets the shoreline surface. Similarly, stone seawalls or those covered by wood can decrease shallow water turbulence and lakeward wave energy reflection while still providing shoreline stabilization.

**3.0 Lake Uses**

A public meeting was held September 1, 2007 to discuss aquatic plant survey results and to discuss results of the user survey which was conducted at the PLCC summer picnic. (Appendix A contains detailed results from the user survey.) Figure 6 details the responses of users in regards to perceived problems in Pretty Lake. Fifty-four lake users responded to the survey this year. The main concern of Pretty Lake users is that too many aquatic plants are present in the lake (43%). Only 4 % of users indicated that there are not enough aquatic plants in the lake. Concerns regarding too many boats on the lake and those dealing with perceived fish population problems are an issue for 20% of Pretty Lake users. Dredging needs (17%) and overuse by non-residents (15%) are also concerning to Pretty Lake users. Complaints about non-resident use include noise pollution, speeding on and off the lake, and installation of docks at non-resident locations. Only 11% of lake users think that jet ski or other personal watercraft (PWC) use on the lake is an issue, but most seem to like the 10 mph speed limit. It should be noted that the use of jet skis or other PWC's are not allowed at Pretty Lake and that this concern likely stems from individuals against the future use of jet skis on the lake.

A few lake users commented on the need for weed control in the lake and realize that they may have too many invasive aquatic plant species and not enough native plant species. The need to treat Eurasian watermilfoil will continue to be a priority for this lake if it is to be used for recreation. There were only one or two specific comments about dredging even though 20% of users think it is a problem. A consensus on locations that need to be dredged would help determine whether or not there is a serious issue in Pretty Lake.

Individuals who responded to the survey were also asked to note what their primary use of the lake is. The majority of people who responded to the survey use Pretty Lake for swimming (93%). Eighty-five percent of individuals use the lake for boating and seventy percent of lake users fish on Pretty Lake. Another 13% of individuals on Pretty Lake use it for irrigation purposes. No one who responded to the survey admitted to using the lake for drinking water. A small percentage of lake users (6%) responded with "other" activities as their primary use on Pretty Lake. Hunting, rest, and sailing were among their primary uses. The public access site for Pretty Lake is located on the west side of the lake off of County Road 890 East.

Overall, the use of Pretty Lake is for swimming and low-speed recreation. As such, the public does not prioritize specific areas for high or low-impact recreation. Furthermore, no areas were identified by the public where aquatic plant densities or communities interfere with lake use.

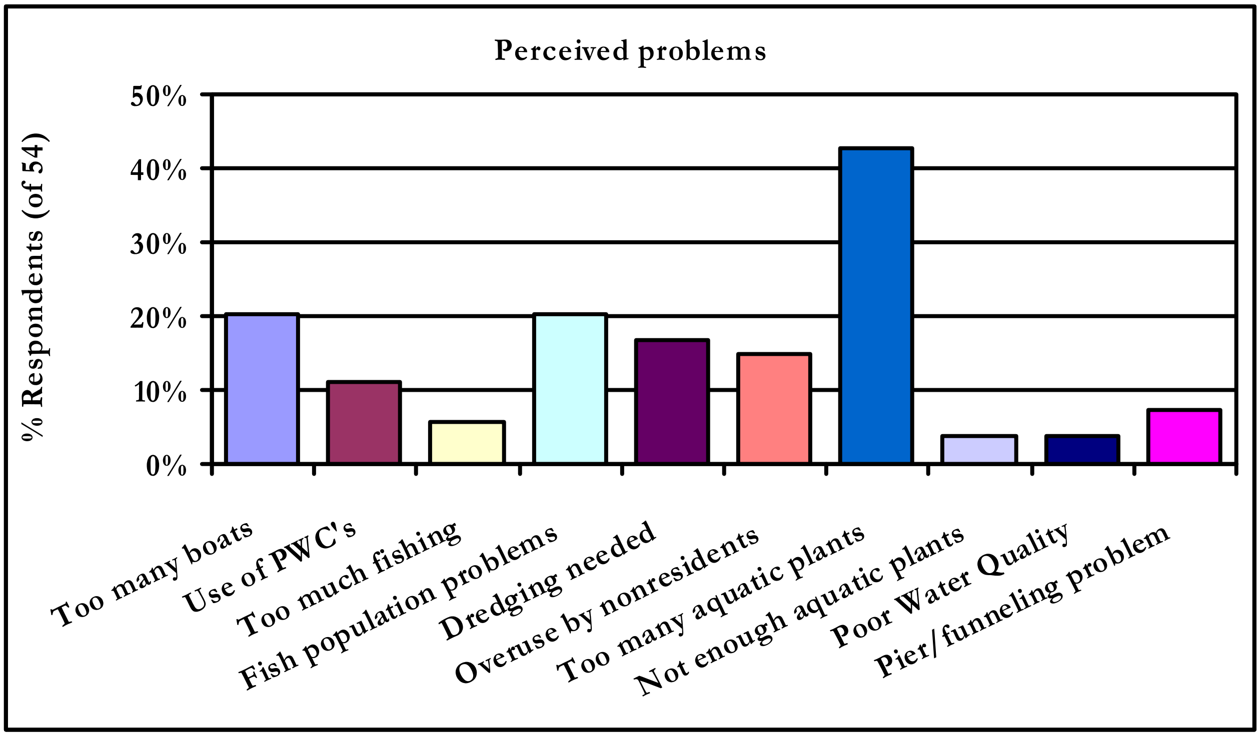



**Figure 6. Perceived problems from Pretty Lake users.**

## 4.0 Fisheries

The Pretty Lake fishery was initially surveyed by the Indiana Department of Natural Resources (IDNR) in 1964 with subsequent general fishery surveys in 1973, 1979, 1983, and 1996. Angler-use or creel surveys were conducted concurrently with the general survey in 1983 and 1996. Special investigations were performed in 1979, 1985, and 1991 to assess the success of trout stocking programs (Koza, 1996). In 2005, a special survey occurred to investigate the success of the walleye stocking program (Ledet, 2005). A complete list of the fish species found during the various assessments can be found in the Pretty Lake Diagnostic Study (JFNew, 2007).

Pretty Lake can be described as primarily a panfish-largemouth bass fishery. Yellow perch and northern pike provide secondary recreational fishery options (Figure 7). Previously, rainbow trout were an important recreational resource and were actively managed through stocking efforts (McGinty, 1966; Peterson, 1974). However, due to a decrease in summer habitat conditions, (primarily water temperature) and angler interest, the stocking program was discontinued (Ledet, 1992). Walleye stocking started during the mid 1990s to provide an additional recreational fishery (Koza, 1996). The walleye stocking program continued on an annual basis from 1993 to present day (Ledet, 2005). In a 2005 evaluation of the walleye stocking program, Ledet (2005) determined that four of the 14 stockings were considered a success based on statewide criteria and recommended that stocking should continue to provide walleye angling opportunities.

The most recent general fisheries survey occurred in 1996 (Koza, 1996). Nineteen fish species were sampled during the survey. Bluegills were the most abundant comprising 51.9% of the overall catch. Redear sunfish (14.4%), largemouth bass (5.7%), rock bass (5.5%), and yellow perch (5.0%) were the next four most abundant species. Walleye composed 2.3% of the total abundance, which is a result of a walleye stocking program that began in the 1990s. Northern pike comprised 1.6% of the total catch.

The water quality of Pretty Lake is reflected in the fishery. Naturally-reproducing populations of largemouth bass and northern pike; a quality bluegill/redear sunfish combined fishery; and a successful walleye stocking program indicate a lake with stable and excellent water quality. Although trout are no longer stocked, lack of angler interest probably played as large of a role in this management change as the loss of summer habitat conditions (primarily water temperatures). If water quality remains stable or continues to improve there should be no significant change to the fishery. However, the introduction of exotic plant and animal species, changes in angler harvest or pressure, or global climate change could have a negative impact on a quality recreational fishery.

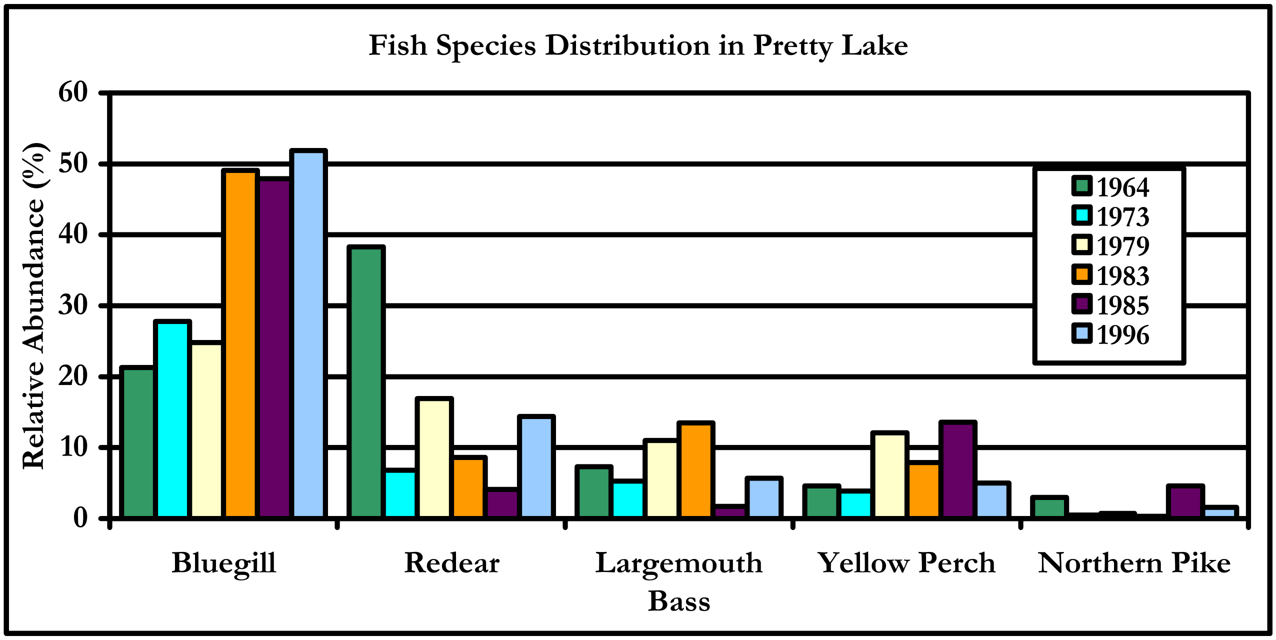



**Figure 7. Percent community composition by number of fish collected for Pretty Lake.**

## 5.0 Problem Statement

The composition and structure of the lake's rooted plant community often provide insight into the long term water quality of a lake. While sampling the lake water's chemistry (dissolved oxygen, nutrient concentrations, etc.) is important, water chemistry sampling offers a single snapshot of the lake's condition. Because rooted plants live for many years in a lake, the composition and structure of this community reflects the water quality of the lake over a longer term.

The composition and structure of a lake's rooted plant community also help determine the lake's fish community composition and structure. Submerged aquatic vegetation provides cover from predators and is a source of forage for many different species of fish (Valley et al., 2004). However, extensive and dense stands of exotic aquatic vegetation can have a negative impact on the fish community. For example, a lake's bluegill population can become stunted because dense vegetation reduces their foraging ability, resulting in slower growth. Additionally, dense stands reduce predation by largemouth bass and other piscivorous fish on bluegill which results in increased intraspecific competition among both prey and predator species (Olsen et al., 1998). Vegetation removal can have variable results on improving fish growth rates (Cross et al., 1992, Olsen et al., 1998). Conversely, lakes with depauperate plant communities may have difficulty supporting some top predators that require emergent vegetation for spawning. In these and other ways, the lake's rooted plant community illuminates possible reasons for a lake's fish community composition and structure.

A lake's rooted plant community impacts the recreational uses of the lake. Swimmers and power boaters desire lakes that are relatively plant-free, at least in certain portions of the lake. In contrast, anglers prefer lakes with adequate rooted plant coverage, since those lakes offer the best fishing opportunity. Before lake users can develop a realistic management plan for a lake, they must understand the existing rooted plant community and how to manage that community. This understanding is necessary to achieve the recreational goals lake users may have for a given lake.

### 5.1 Nuisance and Exotic Plants

Although they have not yet reached the levels observed on many other regional lakes, several nuisance and/or exotic aquatic plant species grow in Pretty Lake. As nuisance species, these species will continue to proliferate if unmanaged, so data collected during the plant survey will be outdated quickly and should not be used to precisely locate nuisance species individuals or stands. (Additionally, it is likely that the watershed supports many terrestrial nuisance species plant species, but this discussion will focus on the aquatic nuisance species.) The plant survey revealed the presence of two submerged, aggressive exotics: Eurasian watermilfoil (Figure 8) and curly-leaf pondweed (Figure 9). Pretty Lake also supports two emergent exotic plant species: purple loosestrife (Figure 10) and reed canary grass (Figure 11). As exotic invasive species, these species have the potential to proliferate if left unmanaged. It is possible that these or other exotic species could exist within the thick emergent portions of the rooted plant community near the east and west ends of the lake but were not observed during this survey or the survey completed during the diagnostic study (JFNew, 2007).

**Figures 8. Eurasian watermilfoil (*Myriophyllum spicatum*) and Figure 9. Curly-leaf pondweed (*Potamogeton crispus*).**

**Figure 10. Purple loosestrife (*Lythrum salicaria*) and Figure 11. Reed canary grass (*Phalaris arundinacea*).**

### 5.1.1 Eurasian watermilfoil

The presence of Eurasian watermilfoil in Pretty Lake is of concern, but it is not uncommon for lakes in the region. Eurasian watermilfoil is an aggressive, non-native species common in northern Indiana lakes. It often grows in dense mats excluding the establishment of other plants. For example, once the plant reaches the water's surface, it will continue growing horizontally across the water's surface. This growth pattern has the potential to shade other submerged species preventing their growth and establishment. In addition, Eurasian watermilfoil does not provide the same habitat potential for aquatic fauna as many native pondweeds. Its leaflets serve as poor substrate for aquatic insect larva, the primary food source of many panfish.

### 5.1.2 Curly-leaf pondweed

Depending upon water chemistry, curly-leaf pondweed can be more or less aggressive than Eurasian watermilfoil. Its presence in the lake is a concern because, like Eurasian watermilfoil, curly-leaf pondweed can spread across the lake's surface forming dense mats ultimately shading out native species. Like many exotic invasive species, curly-leaf pondweed gains a competitive advantage over native submerged species by sprouting early in the year. The species can do this because it is more tolerant of cooler water temperature than many of the native submerged species. Curly-leaf pondweed experiences a die-back during early to mid-summer. This die-back can degrade water quality by releasing nutrients into the water column and increasing the biological oxygen demand.

### 5.1.3 Purple loosestrife

Purple loosestrife is an aggressive, exotic species introduced into this country from Eurasia for use as an ornamental garden plant. Like Eurasian watermilfoil, purple loosestrife has the potential to dominate habitats, in this case wetland and shoreline communities, excluding native plants. The stiff, woody composition of purple loosestrife makes it a poor food source substitute for many of the native emergents it replaces. In addition, the loss of diversity that occurs as purple loosestrife takes over plant communities lowers the wetland and shoreline habitat quality for waterfowl, fishes, and aquatic insects.

### 5.1.4 Reed canary grass

Like purple loosestrife, reed canary grass is native to Eurasia. Farmers used (and many likely still use) the species for erosion control along ditch banks or as marsh hay. The species escaped via ditches and has spread to many of the wetlands in the area. Swink and Wilhelm (1994) indicate that reed canary grass commonly occurs at the toe of the upland slope around a wetland. Reed canary grass was often observed above the ordinary high water mark around Pretty Lake. Like other nuisance species, reed canary grass forms a monoculture mat excluding native wetland/shoreline plants. This limits a wetland's or shoreline's diversity ultimately impacting the habitat's functions.

### 5.1.5 Hydrilla

Although it was not identified in Pretty Lake during the aquatic plant survey, another exotic, invasive species, hydrilla, was identified for the first time in Indiana at Lake Manitou in Fulton County in 2006. Hydrilla is a submerged plant that resembles common water weed. However, hydrilla can tolerate lower light levels and higher nutrient concentrations than most native aquatic species. Because of its special adaptations, hydrilla can live in deeper water and photosynthesize earlier in the morning than other aquatic species. Because of these factors, hydrilla is often present long before it becomes readily apparent. It often grows quickly below the water and becomes obvious only after out-competing other species and forming a monoculture. Dense mats of hydrilla often cause pH imbalances and temperature and dissolved oxygen fluctuations. This allows hydrilla to out-compete other aquatic-plant species and can cause imbalances in the fish community.

## 6.0 AquaticVegetation Management Goals and Objectives

Listed below are three goals formulated by the LARE program staff and the DNR Division of Fish and Wildlife Biologists and approved by the Pretty Lake Conservation Club. The objectives and actions used to meet the goals are discussed in the **Management Action Strategy Section**.

Aquatic Plant Management Goals:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts towards preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

## 7.0 Plant Management History

This year (2007) represents the first year that Pretty Lake is part of the LARE-funded aquatic plant management program. Additionally, no locally sponsored treatment of exotic vegetation occurred on Pretty Lake in the last few years (2005-2007). The only aquatic plant treatment which has occurred at Pretty Lake took place via private landowners.

In August 2006, treatment of 1.34 acres of Pretty Lake with Reward, Aquathal K, copper sulfate, 2-4D, Renovate, Hydrathal 191, Komeen, and Cygnet was approved. The treatment targeted Eurasian watermilfoil and curly-leaf pondweed. Other species potentially affected by the treatment included chara, coontail, common naiad, common water weed, flat-stem pondweed, and eel grass. The same area was treated again in 2007 using the same chemicals. In June 2007, 1.34 acres of Pretty Lake were targeted for treatment of Eurasian watermilfoil, curly-leaf pondweed, and algae. Other species potentially affected by the treatment include coontail, chara, American elodea, common naiad, eel grass, and flat-stem pondweed. No other permitted treatments occurred in the last few years at Pretty Lake.

## 8.0 Aquatic Plant Community Characterization

### 8.1 Methods

JFNew surveyed Pretty Lake's plant community on May 30 and July 30, 2007 according to the Indiana Department of Natural Resources sampling protocols (IDNR, 2007). JFNew examined the entire littoral zone of the lake during each of the two assessments. Surveys were completed using the Tier II survey protocol updated by the IDNR LARE staff in May 2007 (IDNR, 2007). The survey protocol generally follows previous Tier II protocols and is most similar to the 2006 protocol, which requires that the sampling points be stratified over the entire depth of the lake's littoral zone. Total points sampled per stratum were determined as follows:

1. Appendix D of the survey protocol was consulted to determine the number of points to be sampled. This determination was based on the lake size (surface area) and trophic status.
2. Table 3 of the survey protocol was referenced as an indicator of the number of sample points per stratum. Table 3 lists the sampling strategy for Pretty Lake.

Stratum refers to depth at which plants were observed. Dominance presented in subsequent tables was calculated by the IDNR protocol. The density scale presented in subsequent tables provides a measure of the density of a species. The percentage of plants found within a density measure indicates the frequency of plants found over all the sampling points.

**Table 3. Tier II sampling strategy for Pretty Lake using the 2007 Tier II protocol.**

| Lake | Size | Trophic Status | Number of Points | Stratification of Points |
|---|---|---|---|---|
| Pretty Lake | 184 acres | Mesotrophic | 50 | 14 pts 0-5 foot stratum<br>14 pts 5-10 foot stratum<br>12 pts 10-15 foot stratum<br>10 pts 15-20 foot stratum |

### 8.2 2007 Sampling Results

Spring (May) and summer (July) exotic species surveys and spring and summer Tier II surveys were completed on Pretty Lake in 2007 by JFNew. The survey schedule is detailed in Table 4. No samples were sent to an outside taxonomist for vouchering or identification.

**Table 4. Survey schedule for exotic species and Tier II surveys.**

| Survey | Date |
|---|---|
| Spring exotic species survey | May 30, 2007 |
| Summer exotic species survey | July 30, 2007 |
| Spring Tier II -Spring | May 30, 2007 |
| Summer Tier II -Summer | July 30, 2007 |

#### 8.2.1 Exotic Species and Plant Community Mapping

Exotic species locations are shown in Figure 12. Additional plant community information is discussed in detail in the following sections.

**Spring Assessment**

The dominant plant species found in Pretty Lake are chara, coontail, nitella, grassy pondweed, and sago pondweed (Table 5). There are a few problem areas which are located throughout the lake.

(These are discussed in more detail in the Beneficial and Problem Plants Section.) Eurasian watermilfoil was identified in the northeast region of the lake (Job's Hole and the mouth of Deal Ditch) and in a few locations along the southern shoreline. The main concern identified during the spring assessment was the presence of Eurasian watermilfoil along the northern shoreline of Pretty Lake. Eurasian watermilfoil is also present to a lesser extent along the southeast and western shorelines. In total, Eurasian watermilfoil covered approximately 12 acres of Pretty Lake during the spring survey. Two small areas (<1 acre) of curly-leaf pondweed were identified during the spring assessment (Figure 12). Curly-leaf pondweed is also likely present in a small number of locations throughout the lake. However, surveys were not conducted at the peak of curly-leaf pondweed growth. To adequately assess the density of curly-leaf pondweed, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Pretty Lake. No endangered, threatened, or rare species were identified within Pretty Lake during the spring assessment.

**Table 5. Aquatic plant species identified within Pretty Lake during the spring, May 30, 2007 and summer, July 30, 2007, aquatic plant surveys.**

| Scientific Name | Common Name | Stratum | Spring | Summer |
|---|---|---|---|---|
| *Agrostis alba* | Redtop | Emergent | X | X |
| *Agrostis alba palustris* | Bent grass | Emergent | X | X |
| *Asclepias incarnata* | Swamp milkweed | Emergent | X | X |
| *Brasenia schreberi* | Water shield | Emergent | X | X |
| *Ceratophyllum demersum* | Coontail | Submergent | X | X |
| *Chara* species | Musk grass species | Submergent | X | X |
| *Cicuta bulbifera* | Bulblet-bear water-hemlock | Emergent | X | X |
| *Carex comosa* | Bearded sedge | Emergent | X | X |
| *Decodon verticillatus* | Whirled loosestrife | Emergent | X | X |
| *Eleocharis erythropoda* | Bald spikerush | Emergent | X | X |
| *Eleocharis palustris* | Creeping spikerush | Emergent | X | X |
| *Elodea canadensis* | Common water weed | Submergent | X | |
| *Elodea nuttallii* | Nuttall's water weed | Submergent | X | |
| *Filamentous algae* | Filamentous algae | Algae | X | |
| *Hibiscus* species | Hibiscus | Emergent | X | X |
| *Heteranthera dubia* | Water star grass | Submergent | X | |
| *Iris virginica* | Blue-flag iris | Emergent | X | X |
| *Juncus* species | Rush species | Emergent | X | X |
| *Leersia oryzoides* | Rice cut grass | Emergent | | X |
| *Lemna minor* | Common duckweed | Floating | X | X |
| *Lemna trisulca* | Star duckweed | Floating | X | X |
| *Lythrum salicaria* | Purple loosestrife | Emergent | X | X |
| *Mentha spicata* | Spearmint | Emergent | X | X |
| *Myriophyllum exalbescens* | Northern watermilfoil | Submergent | X | X |
| *Myriophyllum heterophyllum* | Various-leaf watermilfoil | Submergent | X | X |
| *Myriophyllum spicatum* | Eurasian watermilfoil | Submergent | X | X |
| *Najas flexilis* | Slender naiad | Submergent | X | |
| *Najas guadalupensis* | Southern naiad | Submergent | X | |
| *Najas marina* | Spiny naiad | Submergent | | X |

| Scientific Name | Common Name | Stratum | Spring | Summer |
|---|---|---|---|---|
| *Nelumbo lutea* | American lotus | Floating | X | X |
| *Nitella species* | Nitella species | Submergent | X | X |
| *Nuphar advena* | Spatterdock | Floating | X | X |
| *Numphaea tuberosa* | White water lily | Floating | X | X |
| *Phalarus arundinacea* | Reed canary grass | Emergent | X | X |
| *Polygonum amphibium stipulaceum* | Water knotweed | Emergent | X | X |
| *Polygonum coccineum* | Water hearsease | Emergent | X | X |
| *Polygonum lapathifolium* | Willow-weed | Emergent | X | X |
| *Pontederia cordata* | Pickerel weed | Emergent | X | X |
| *Potamogeton amplifolius* | Large-leaf pondweed | Submergent | X | X |
| *Potamogeton crispus* | Curly leaf pondweed | Submergent | X | |
| *Potamogeton gramineus* | Grassy pondweed | Submergent | X | X |
| *Potamogeton illinoensis* | Illinois pondweed | Submergent | X | X |
| *Potamogeton natans* | Floating-leaf pondweed | Submergent | X | |
| *Potamogeton nodosus* | Long-leaf pondweed | Submergent | | X |
| *Potamogeton zosteriformis* | Flat-stem pondweed | Submergent | X | X |
| *Scirpus pungens* | Chairmaker's rush | Emergent | X | X |
| *Spirodela polyrhiza* | Large duckweed | Floating | X | X |
| *Stuckenia pectinatus* | Sago pondweed | Submergent | X | X |
| *Typha angustifolia* | Narrow-leaf cattail | Emergent | X | X |
| *Typha* x *glauca* | Blue cattail | Emergent | X | X |
| *Typha latifolia* | Broad-leaf cattail | Emergent | X | X |
| *Utricularia vulgaris* | Common bladderwort | Submergent | X | |
| *Vallisneria americana* | Eel grass | Submergent | X | X |

**Summer Assessment**

In addition to the dominant plants found during the spring survey, JFNew biologists identified eel grass and spiny naiad as dominant species. Eurasian watermilfoil density increased from spring to summer and was found in additional locations. Dense areas of Eurasian watermilfoil were identified in both the northeast corner of the lake (Job's Hole) and along the western shoreline. In total, Eurasian watermilfoil was identified in a total of 14.4 acres of Pretty Lake during the summer survey. Despite the increase in density and distribution, Eurasian watermilfoil did not inhibit recreational use of Pretty Lake during the summer survey. No curly-leaf pondweed was found in Pretty Lake during the summer survey. No endangered, threatened, or rare species were identified within Pretty Lake during the summer assessment.


**Figure 12. Eurasian watermilfoil and curly-leaf pondweed locations in Pretty Lake.**

### 8.2.2 Tier II

Two Tier II surveys were completed in Pretty Lake in order to document changes in the plant community throughout the growing season. The Tier II surveys were completed on May 30, 2007 (spring) and on July 30, 2007 (summer). The raw dataset is included in Appendix B.

Transparency was measured at the deepest spot in the lake using a Secchi disk prior to both sampling events. Transparency was found to be 12.7 (3.9 m) feet during the spring and 15.5 feet (4.7 m) during the summer survey. Based on the survey protocol, plants were sampled to a depth of 20 feet. However, plants were only present to a maximum depth of 18 feet during the spring survey. During the summer survey, plants were present to a depth of 25 feet. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Appendix C.

During the spring survey, musk grass dominated the plant community over all depths (0-20 feet; Table 6). This species was found at the highest percentage of sites throughout the entire sampled water column (56%). Throughout the entire sampled water column, nitella, sago pondweed, coontail, and grassy pondweed were relatively dense and were found at 27%, 27%, 24%, and 22% of sites, respectively (Appendix C). Musk grass dominated the shallowest stratum (0-5 foot) and was identified at 100% of sites in this stratum. Musk grass also possessed the highest dominance (42.5) and was more than four times as dominant as other species in this stratum. Grassy and sago pondweeds were also prevalent in the 0-5 foot stratum and were present at 50% of the sample sites. Coontail was present at approximately 33% of sites in the 0-5 foot stratum but was present in relatively low density. In deeper water, Musk grass maintained its frequency; however, it was only present at 55% of sites in the 5-10 foot stratum, 35% of sites in the 10-15 foot stratum, and at only 12.5% of sites in the 15-20 foot stratum. Musk grass's density decreased as well with dominance of 11.11 at 5-10 foot, 9.41 at 10-15 foot, and 2.5 at 15-20 foot. Grassy and sago pondweeds and coontail also decreased in frequency and density with increasing depths. Conversely, nitella's frequency and dominance increased with increasing water depth. Nitella was not present in the 0-5 foot strata, occurred at 16.7% of sites in the 5-10 foot strata, and was the most frequent species in the 10-15 foot and 15-20 foot strata observed at 47% and 62% of sites, respectfully. Eurasian watermilfoil and curly-leaf pondweed were present in relatively low densities throughout the entire sampled water column. Eurasian watermilfoil was present at 12.5% of sites in the 0-5 foot stratum and 22.2% of sites in the 5-10 foot stratum. Dominance of Eurasian watermilfoil also increased from the 0-5 foot to the 5-10 foot strata measuring 2.5 and 8.9, respectfully. Eurasian watermilfoil was the second most prevalent species in the 5-10 foot stratum. Curly-leaf pondweed was absent from the 0-5 foot stratum and occurred at 11.1% of sites in the 5-10 foot and 5.9% of sites in the 10-15 foot stratum, respectfully. Figures 13-15 document sampling locations (Figure 13) and sites where Eurasian watermilfoil (Figure 14) and curly-leaf pondweed (Figure 15) were identified during the spring survey.

**Table 6. Spring Tier II survey metrics and results for entire lake strata as collected May 30, 2007.**

| | | | | | |
|---|---|---|---|---|---|
| Total Sites: | 59 | Mean species / site: | 2.39 | Native diversity: | 0.872 |
| Littoral Sites: | 58 | Maximum species / site: | 6.00 | Species diversity: | 0.887 |
| Littoral Depth (ft): | 18 | Number of species: | 15.00 | SE Mean natives / site: | 0.187 |
| Date: | 5/30/07 | Littoral sites with plants: | 51.00 | Mean natives / site: | 2.220 |
| Lake: | Pretty | Secchi(ft): | 12.7 | SE Mean species / site: | 0.211 |

| **All depths (0-10')** | | **Frequency of Occurrence** | **Frequency per Species** | | | | **Dominance** |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | **0** | **1** | **3** | **5** | |
| *Chara* species | Musk grass species | 55.93 | 44.07 | 40.68 | 13.56 | 1.69 | 17.97 |
| *Nitella species* | Nitella species | 27.12 | 72.88 | 25.42 | 1.69 | 0.00 | 6.10 |
| *Stuckenia pectinatus* | Sago pondweed | 27.12 | 72.88 | 27.12 | 0.00 | 0.00 | 5.42 |
| *Ceratophyllum demersum* | Coontail | 23.73 | 76.27 | 22.03 | 1.69 | 0.00 | 5.42 |
| *Potamogeton gramineus* | Grassy pondweed | 22.03 | 77.97 | 22.03 | 0.00 | 0.00 | 4.41 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 11.86 | 88.14 | 10.17 | 0.00 | 1.69 | 3.73 |
| *Vallisneria americana* | Eel grass | 11.86 | 88.14 | 11.86 | 0.00 | 0.00 | 2.37 |
| *Potamogeton illinoensis* | Illinois pondweed | 11.86 | 88.14 | 11.86 | 0.00 | 0.00 | 2.37 |
| *Najas guadalupensis* | Southern naiad | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton crispus* | Curly-leaf pondweed | 5.08 | 94.92 | 3.39 | 1.69 | 0.00 | 1.69 |
| *Najas flexilis* | Slender naiad | 8.47 | 91.53 | 8.47 | 0.00 | 0.00 | 1.69 |
| *Myriophyllum exalbescens* | Northern watermilfoil | 8.47 | 91.53 | 8.47 | 0.00 | 0.00 | 1.69 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Heteranthera dubia* | Water star grass | 1.69 | 98.31 | 1.69 | 0.00 | 0.00 | 0.34 |
| *Filamentous algae* | Filamentous Algae | 3.39 | | | | | |

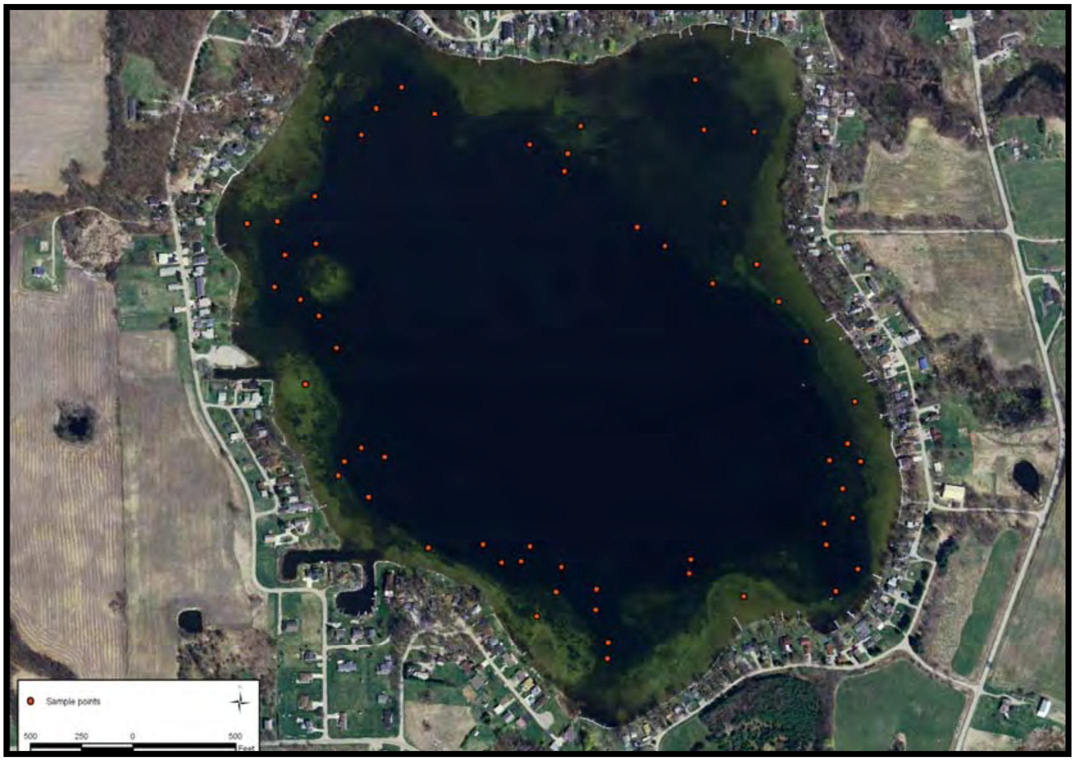



**Figure 13. Sampling locations for the May 30, 2007 Tier II Survey at Pretty Lake.**


**Figure 14. Pretty Lake Eurasian watermilfoil locations and densities as surveyed May 30, 2007.**


**Figure 15. Pretty Lake curly-leaf pondweed locations and densities as surveyed May 30, 2007.**

During the summer survey, JFNew biologists observed that chara was still the most abundant species in Pretty Lake (Table 7). Musk grass was found at the highest percentage of sites throughout the entire sampled water column (51%). Musk grass dominated the shallowest stratum (0-5 foot) and was identified at 100% of sites in this stratum. Musk grass also possessed the highest dominance (82.5) and was more than six times as dominant as other species in this stratum.

Spiny naiad, grassy pondweed, and eel grass were also prevalent in the 0-5 foot stratum and were present at 56%, 50%, and 44% of the sample sites, respectfully. Eurasian watermilfoil was also present; however this species occurred at only 12.5% of sites with very low density. In deeper water, chara maintained its frequency; it was present at 69% of sites in the 5-10 foot stratum, 62.5% of sites in the 10-15 foot stratum, and none of the sites in the 15-20 foot and 20-25 foot strata. Musk grass's density decreased as well with a dominance of 60.0 at 5-10 foot and 32.5 at 10-15 foot. Grassy pondweed and eel grass both increased in frequency and density in the 5-10 foot stratum. Spiny naiad decreased in frequency and density from the 0-5 foot to the 5-10 foot stratum. Frequencies and densities for all three species decreased with increasing depth. Conversely, nitella's frequency and dominance increased with increasing water depth. Nitella was not present in the 0-5 foot or the 5-10 foot stratum, occurred at 12.5% of sites in the 10-15 foot stratum, and was the most frequent species in the 15-20 foot and 20-25 foot strata observed at 57% and 100% of sites, respectfully. Eurasian watermilfoil was present in relatively low density throughout the entire sampled water column. Eurasian watermilfoil was present at 12.5% of sites in the 0-5 foot stratum, 46% of sites in the 5-10 foot stratum, and 12.5% of sites in the 10-15 foot stratum. Dominance of

Eurasian watermilfoil also increased from the 0-5 foot to the 5-10 foot strata measuring 2.5 and 15.4, respectfully. Curly-leaf pondweed was absent from all depths in Pretty Lake. Figures 16-17 document sampling locations (Figure 16) and sites where Eurasian watermilfoil (Figure 17) was identified during the summer survey.

**Table 7. Summer Tier II survey metrics and results for entire lake strata as collected July 30, 2007.**

| | | | | | |
|---|---|---|---|---|---|
| Total Sites: | 59 | Mean species / site: | 2.73 | Native diversity: | 0.887 |
| Littoral Sites: | 58 | Maximum species / site: | 7 | Species diversity: | 0.896 |
| Littoral Depth (ft): | 25 | Number of species: | 14 | SE Mean natives / site: | 0.238 |
| Date: | 7/30/07 | Littoral sites with plants: | 55 | Mean natives / site: | 2.576 |
| Lake: | Pretty | Secchi(ft): | 15.5 | SE Mean species / site: | 0.246 |

| **All depths (0-10')** | | **Frequency of Occurrence** | **Frequency per Species** | | | | **Dominance** |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | | **0** | **1** | **3** | **5** | |
| *Chara* species | Musk grass species | 50.85 | 49.15 | 8.47 | 10.17 | 32.20 | 40.00 |
| *Nitella species* | Nitella species | 27.12 | 72.88 | 16.95 | 10.17 | 0.00 | 9.49 |
| *Stuckenia pectinatus* | Sago pondweed | 23.73 | 76.27 | 16.95 | 3.39 | 3.39 | 8.81 |
| *Najas marina* | Spiny naiad | 30.51 | 69.49 | 25.42 | 5.08 | 0.00 | 8.14 |
| *Vallisneria americana* | Eel grass | 27.12 | 72.88 | 22.03 | 5.08 | 0.00 | 7.46 |
| *Potamogeton gramineus* | Grassy pondweed | 27.12 | 72.88 | 22.03 | 5.08 | 0.00 | 7.46 |
| *Ceratophyllum demersum* | Coontail | 25.42 | 74.58 | 22.03 | 3.39 | 0.00 | 6.44 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 15.25 | 84.75 | 13.56 | 0.00 | 1.69 | 4.41 |
| *Potamogeton illinoensis* | Illinois pondweed | 20.34 | 79.66 | 20.34 | 0.00 | 0.00 | 4.07 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 6.78 | 93.22 | 5.08 | 1.69 | 0.00 | 2.03 |
| *Myriophyllum exalbescens* | Northern water milfoil | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Potamogeton nodosus* | Long-leaf pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Myriophyllum heterophyllum* | Various-leaf watermilfoil | 1.69 | 98.31 | 1.69 | 0.00 | 0.00 | 0.34 |

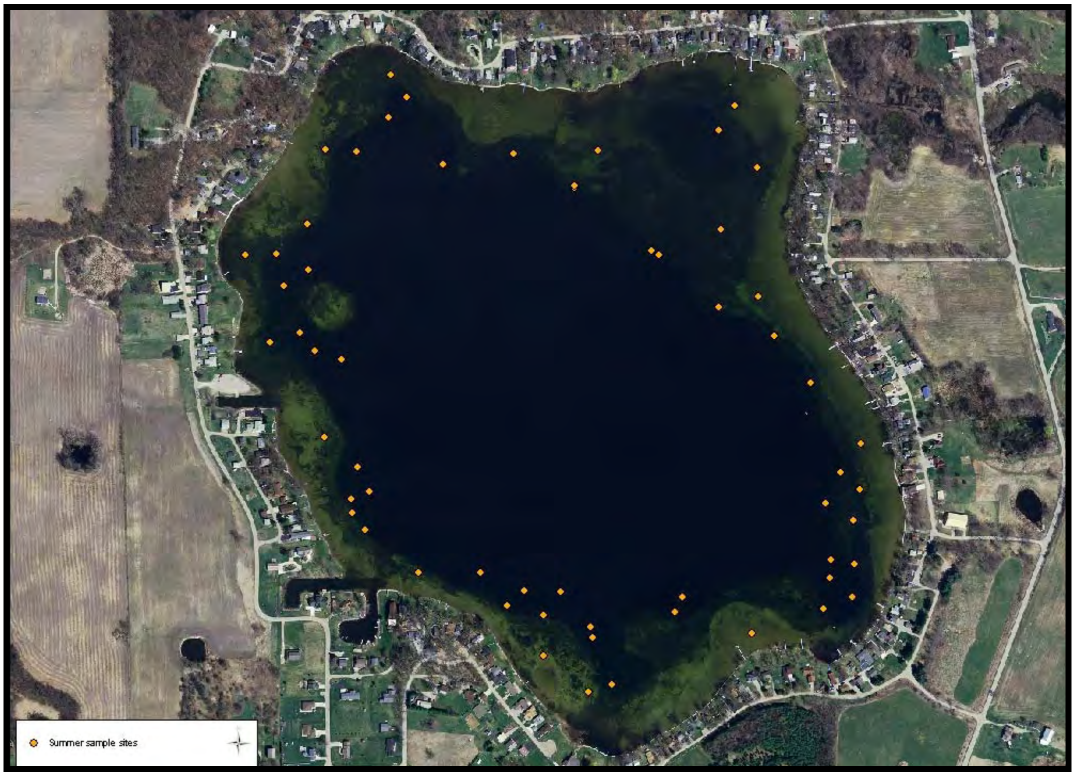



**Figure 16. Sampling locations for the July 30, 2007 Tier II Survey at Pretty Lake.**

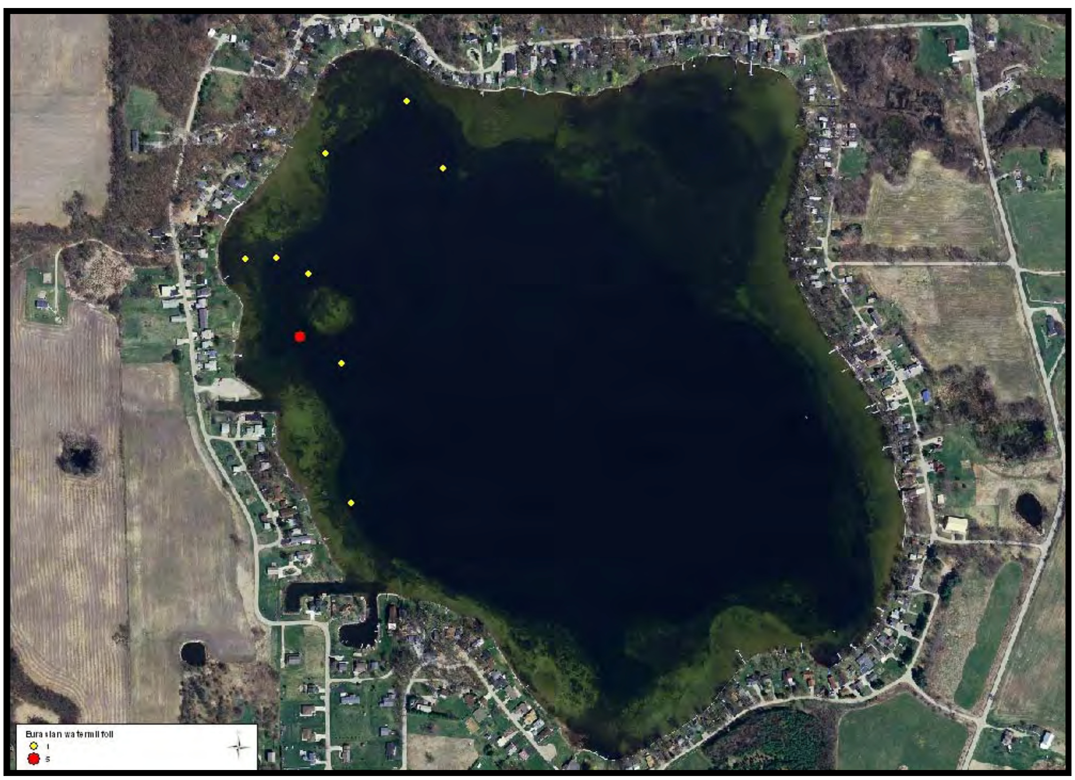



**Figure 17. Pretty Lake Eurasian watermilfoil locations and densities as surveyed July 30, 2007.**

When recently collected data is compared with data collected by Pearson (2004), Pretty Lake possessed greater diversity than the lakes surveyed by Pearson (Table 8). Pretty Lake possessed 14 to 15 species during the spring and summer surveys, while Pearson collected only eight species on average. Pretty Lake also possessed more native species (13 compared to Pearson's 7).

**Table 8. A comparison of the aquatic plant community in Pretty Lake with the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes.**

| | Spring (5/30/07) | Summer (7/30/07) | Indiana Average (2004) |
|---|---|---|---|
| Percentage of littoral sites containing plants | 86 | 95 | - |
| Number of species collected | 15 | 14 | 8 |
| Number of native species collected | 13 | 13 | 7 |
| Rake Diversity (SDI) | 0.89 | 0.90 | 0.62 |
| Native Rake Diversity (SDI) | 0.87 | 0.89 | 0.5 |
| Species Richness (Avg # species/site) | 2.39 | 2.83 | 1.61 |
| Native Species Richness | 2.37 | 2.82 | 1.33 |
| Site Species Native diversity | | | 0.56 |

**Aquatic Vegetation Sampling Discussion**

The primary focus of an aquatic vegetation management plan is to document changes within the aquatic plant community throughout the growing season and to develop plans for future work. Eurasian watermilfoil was found at more sites during the summer survey (15% compared to 11% during spring). Conversely, curly-leaf pondweed was not identified during the summer survey compared to 5% of sites during the spring survey. Additionally, long-leaf pondweed, variable-leaf watermilfoil, and spiny naiad were identified during the summer survey. None of these species were present during the spring survey. Water star grass, slender naiad, and southern naiad were identified during the spring survey, but were not found during the summer survey. Figures 16-17 detail plant sampling locations (Figure 16) and the locations where Eurasian watermilfoil (Figure 17) were identified during the summer surveys.

**8.3 Macrophyte Inventory Discussion**

Considering the number of spatial variables that impact the plant community, such as boat-traffic and changes in nutrient availability, or temporal variables such as climactic conditions, we cannot easily summarize the cause and effect for changes in plant community within in Pretty Lake. Still, general trends emerge from the one year's data that are useful for the purpose of management decisions. Table 7 details changes in the site frequency, relative and mean density and dominance of Eurasian watermilfoil and curly-leaf pondweed in 2007 within Pretty Lake.

**Table 9. Variation in site frequency, relative and mean density, and dominance of Eurasian watermilfoil and curly-leaf pondweed within Pretty Lake in 2007.**

| Common Name | Date | Site Frequency | Relative Density | Mean Density | Dominance |
|---|---|---|---|---|---|
| Eurasian watermilfoil | 5/30/07 | 11.9 | 0.18 | 1.57 | 3.7 |
| | 7/30/07 | 15.3 | 0.22 | 1.44 | 4.4 |
| Curly-leaf pondweed | 5/30/07 | 5.1 | 0.08 | 1.67 | 1.7 |
| | 7/30/07 | 0.0 | 0.0 | 0.0 | 0.0 |

These data serve as a baseline by which future variations in the plant community can be compared. Additionally, these data should allow for some determination of future changes in the plant community due to herbicide treatment or other factors (i.e. climate). With this limited data set, we can comment only on variations in the plant community. It should be noted that variations can occur for many reasons and that observations included hereafter are just that. They may suggest trends, but are inconclusive at this time.

## 9.0 Aquatic Vegetation Management Alternatives

Pretty Lake contains a variety of high quality aquatic plant species and a diverse aquatic plant community. The plants present in the lake are representative of the good water quality present in Pretty Lake. However, the presence of Eurasian watermilfoil, curly-leaf pondweed, and purple loosestrife are of concern. During development of the Diagnostic Study, JFNew recommended the following four actions:

1. Pretty Lake's high rooted plant diversity and high quality plant species should be protected.
2. Pretty Lake residents should take steps to restore the lake's shoreline vegetation.
3. Pretty Lake residents should investigate spot treatment options for areas where aquatic plants are especially dense or occur in nuisance stands.
4. Residents should take action to educate themselves on Eurasian watermilfoil, hydrilla, and other exotic or nuisance species.

Pretty Lake's Aquatic Plant Management plan should incorporate these four objectives. However, the PLCC should not limit their plant management efforts without first exploring all of the options available to them in regards to aquatic plant management at Pretty Lake. A good aquatic plant management plan includes a variety of management techniques applicable to different parts of a lake depending on the lake's water quality, the characteristics of the plant community in different parts of the lake, and lake users' goals for different parts of the lake. Many aquatic plant management techniques, including chemical control, harvesting, and biological control, require a permit from the IDNR. Depending on the size and location of the treatment area, even individual residents may need a permit to conduct a treatment. Residents should contact the IDNR Division of Fish and Wildlife before conducting any treatment.

The following paragraphs describe some aquatic plant management techniques that may be applicable to Pretty Lake, given its specific ecological condition. The alternatives that will be discussed include no action, institutional protection, environmental manipulation, nutrient reduction, mechanical harvesting, bottom covers, biological control, chemical control, and preventive measures.

### 9.1 No Action

Only small areas typically measuring less than 625 square feet have been treated by individual lakeshore property owners at Pretty Lake in the past. With no change in treatment type or methodology, these individuals will likely continue to treat aquatic plants in front of their shorelines. This will likely result in limited control of exotic and/or nuisance species. Additionally, Eurasian watermilfoil, curly-leaf pondweed, and purple loosestrife will likely continue to spread throughout Pretty Lake. Without any action, these species could continue to grow unchecked throughout the basin resulting in a species population that is at a minimum the same size or larger than that observed during the 2007 surveys. This will likely result in a decrease in native plant density and diversity, the formation of a monoculture of exotic species, such as Eurasian watermilfoil, and a loss of the high quality and ETR species observed in Pretty Lake. Additionally, the growth of these nuisance species could increase nutrient cycling within Pretty Lake thereby making more nutrients available to plants and algae ultimately resulting in a decline in the lake's water quality. Conversely, as residents observed in the past, the exotic species present within the aquatic plant community could crash, resulting in no overall negative impacts to Pretty Lake's aquatic plant community.

### 9.2 Institutional Protection of Beneficial Vegetation

Invasive species often colonize disturbed areas first before moving to other areas of the lake. The protection of native and/or beneficial aquatic vegetation can prevent the growth of exotic or nuisance species. This can be accomplished in two ways: limiting user impacts to beneficial plants due to boating or recreational uses and not over-treating beneficial plant beds. Users can restrict the use of specific areas of Pretty Lake through the use of buoys or the establishment of user zones. As high-speed boating is not allowed at Pretty Lake, it is unlikely that user impacts will cause a decline in the native species population density and diversity. The second methodology, over-treating native plant beds, could be a concern in Pretty Lake in the future. This issue occurs when a beneficial, native plant bed is deemed to be nuisance and treatment of this area begins. Once the native plant community is weakened through treatment, exotic species can move into these areas colonizing open sediment. Once a foothold is established, the aggressive, exotic species can then out-compete native varieties. As aquatic plant treatment at Pretty Lake has not occurred on a large-scale before, this has likely not been an issue in the past. Additionally, as intact natural and modified natural plant communities exist along portions of the Pretty Lake shoreline (Figure 5), efforts should be made to protect these areas and maintain natural shoreline and submerged vegetation, if possible. With this in mind, the Pretty Lake Conservation Club should be aware of this issue and tailor their treatment efforts to not impact beneficial native species.

### 9.3 Environmental Manipulation

Environmental manipulation often refers to water-level based changes refer to manipulating the lake's water level to control vegetation. This occurs by raising water levels resulting in drowning the plants or lowering the water level to freeze or heat the aquatic plant community. This type of treatment is limited to lakes where water levels are easily manipulated. Pretty Lake's water control structure does not offer ease of water-level manipulation. Additionally, using this methodology will result in negative impacts to Pretty Lake's high quality plant community.

### 9.4 Nutrient Reduction

Like terrestrial vegetation, aquatic vegetation has several habitat requirements that need to be satisfied in order for the plants to grow or thrive. Aquatic plants depend on sunlight as an energy source. The amount of sunlight available to plants decreases with depth of water as algae, sediment, and other suspended particles block light penetration. Consequently, most aquatic plants are limited to maximum water depths of approximately 10-15 feet (3-4.5 m), but some species, such as Eurasian watermilfoil, have a greater tolerance for lower light levels and can grow in water deeper than 32 feet (10 m) (Aiken et al., 1979). Hydrostatic pressure rather than light often limits plant growth at deeper water depth (15-20 feet or 4.5-6 m).

Water clarity affects the ability of sunlight to reach plants, even those rooted in shallow water. Lakes with clearer water have an increased potential for plant growth. Pretty Lake possesses better water clarity than the average Indiana lake. The Secchi disk depth measured during the plant survey was 12.7 feet (3.9 m) in the spring and 15.5 feet (4.7 m) in the summer. As a general rule of thumb, rooted plant growth is restricted to the portion of the lake where water depth is less than or equal to 2 to 3 times the lake's Secchi disk depth. This holds mostly true in Pretty Lake, where rooted plants were observed in water to a depth of approximately 25 feet (7.6 m), which is about two times the lake's average Secchi disk depth.

Aquatic plants also require a steady source of nutrients for survival. Many aquatic macrophytes differ from microscopic algae (which are also plants) in their uptake of nutrients. Aquatic macrophytes receive most of their nutrients from the sediments via their root systems rather than directly utilizing nutrients in the surrounding water column. Some competition with algae for nutrients in the water column does occur. The amount of nutrients taken from the water column varies for each macrophyte species. Because macrophytes obtain most of their nutrients from the sediments, lakes which receive high watershed inputs of nutrients to the water column will not necessarily have aquatic macrophyte problems. However, lakes with large sources of readily-available nutrients (phosphorus and nitrogen), typically contain higher density aquatic plant communities. Reductions in nutrients can both increase and decrease aquatic plant density. Increases in plant density occur due to improved water clarity, which often results in more plant growth. Pretty Lake contains relatively low nutrient levels and therefore would be expected to contain a low density aquatic plant community. However, good light penetration and a reservoir of nutrients provide a relatively dense and very diverse community. The reduction of nutrient inputs to Pretty Lake will likely not alter the aquatic plant community as a whole. Rather, localized effects of the nutrient reduction will likely occur in the areas of the lake closest to the change in nutrient resources. A detailed list of recommendations targeting nutrient reduction within Pretty Lake are included in the **Integrated Management Action Strategy Section**.

## 9.5 Mechanical Harvesting

Harvesting involves the physical removal of vegetation from lakes. Harvesting should also be viewed as a short-term management strategy. Like chemical control, harvesting needs to be repeated yearly and sometimes several times within the same year. (Some carry-over from the previous year has occurred in certain lakes.) Despite this, harvesting is often an attractive management technique because it can provide lake users with immediate access to areas and activities that have been affected by excessive plant growth. Mechanical harvesting is also beneficial in situations where removal of plant biomass will improve a lake's water chemistry. (Chemical control leaves dead plant biomass in the lake to decay and consume valuable oxygen.)

Macrophyte response to harvesting often depends upon the species of plant and particular way in which the management technique is performed. Pondweeds, which rely on sexual reproduction for propagation, can be managed successfully through harvesting. However, many harvested plants, especially milfoil, can re-root or reproduce vegetatively from the cut pieces left in the water. Plants harvested several times during the growing season, especially late in the season, often grow more slowly the following season (Cooke et al., 1993). Harvesting plants at their roots is usually more effective than harvesting higher up on their stems (Olem and Flock, 1990). This is especially true with Eurasian watermilfoil and curly-leaf pondweed. Benefits are also derived if the cut plants and the nutrients they contain are removed from the lake. Harvested vegetation that is cut and left in the lake ultimately decomposes, contributing nutrients and consuming oxygen.

Hand harvesting may be the most economical means of harvesting on Pretty Lake. Hand harvesting is recommended in small areas where human uses are hampered by extensive growths (docks, piers, beaches, boat ramps). In these small areas, plants can be efficiently cut and removed from the lake with hand cutters such as the Aqua Weed Cutter (Figure 18). In less than one hour every 2-3 weeks, a homeowner can harvest 'weeds' from along docks and piers. Depending on the model, hand-harvesting equipment for smaller areas cost from $50 to $1500 (McComas, 1993). To reduce the cost, several homeowners can invest together in such a cutter. Alternatively, a lake association may purchase one for its members. This sharing has worked on other Indiana lakes with aquatic plant problems. Use of a hand harvester is more efficient and quick-acting, and less toxic for small areas than spot herbicide treatments. Hand harvesting or using a boat-mounted mechanical harvester to harvest vegetation covering areas larger than 625 square feet requires a permit from the IDNR Division of Fish and Wildlife. (The IDNR Division of Fish & Wildlife can assist lake residents in determining whether a permit is needed and how to obtain one.)

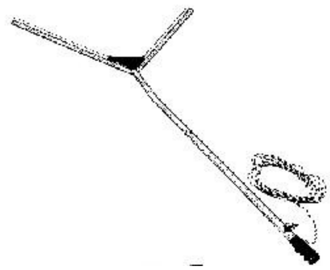


**Figure 18. An aquatic weed cutter designed to cut emergent weeds along the edge of ponds. It has a 48" cutting width, uses heavy-duty stainless steel blades, can be sharpened, and comes with an attached 20' rope and blade covers.**

### 9.6 Bottom Covers

Bottom shading by covering bottom sediments with fiberglass or plastic sheeting materials provides a physical barrier to macrophyte growth. Buoyancy and permeability are key characteristics of the various sheeting materials. Buoyant materials (polyethylene and polypropylene) are generally more difficult to apply and must be weighted down. Unfortunately, sand or gravel anchors used to hold buoyant materials in place can act as substrate for new macrophyte growth. Any bottom cover materials placed on the lake bottom must be permeable to allow gases to escape from the sediments; gas escape holes must be cut in impermeable liners. Commercially available sheets made of fiberglass-coated screen, coated polypropylene, and synthetic rubber are non-buoyant and allow gases to escape, but cost more (up to $66,000 per acre or $163,000 per hectare for materials, Cooke and Kennedy, 1989). Indiana regulations specifically prohibit the use of bottom covering material as a base for beaches.

Due to the prohibitive cost of the sheeting materials, sediment covering is recommended for only small portions of lakes, such as around docks, beaches, or boat mooring areas. This technique may be ineffective in areas of high sedimentation, since sediment accumulated on the sheeting material provides a substrate for macrophyte growth. The IDNR requires a permit for any permanent structure on the lake bottom, including anchored sheeting.

### 9.7 Biological Control

Biological control involves the use of one species to control another species. Often when a plant species that is native to another part of the world is introduced to a new region with suitable habitat, it grows rapidly because its native predators have not been introduced to the new region along with the plant species. This is the case with some of the common pest plants in northeast Indiana such as Eurasian watermilfoil and purple loosestrife. Neither of these species is native to Indiana, yet both exist in and around Lagrange County.

Researchers have studied the ability of various insect species to control both Eurasian watermilfoil and purple loosestrife. Cooke et al. (1993) point to four different species that may reduce Eurasian watermilfoil infestations: *Triaenodes tarda*, a caddisfly, *Cricotopus myriophylii*, a midge, *Acentria nivea*, a moth and *Litodactylus leucogaster*, a weevil. Recent research efforts have focused on the potential for *Euhrychiopsis lecontei*, a native weevil, to control Eurasian watermilfoil. Purple loosestrife biocontrol researchers have examined the potential for three insects, *Gallerucella calmariensis, G. pusilla*, and *Hylobius transversovittatus,* to control the plant.

While the population of purple loosestrife on Pretty Lake is relatively small and therefore may not be suitable for biological control efforts, it may be worthwhile for Pretty Lake residents to understand the common biocontrol mechanisms for this species should the situation on the lake change. Likewise, as Eurasian watermilfoil is present in Pretty Lake, residents should be cognizant of infestation issues and biocontrol mechanisms for Eurasian watermilfoil. Therefore, treatment options for the plant are discussed below merely as reference material for use in case of future infestation. Residents should also be aware that under new regulations an IDNR permit is required for the implementation of a biological control program on a lake.

### 9.7.1 Biological Control of Eurasian Watermilfoil

*Euhrychiopsis lecontei* has been implicated in a reduction of Eurasian watermilfoil in several Northeastern and Midwestern lakes (USEPA, 1997). *E. lecontei* weevils reduce milfoil biomass by two means: one, both adult and larval stages of the weevil eat different portions of the plant and two, tunneling by weevil larvae cause the plant to lose buoyancy and collapse, limiting its ability to reach sunlight. The weevils' actions also cut off the flow of carbohydrates to the plant's root crowns impairing the plant's ability to store carbohydrates for over wintering (Madsen, 2000). Techniques for rearing and releasing the weevil in lakes have been developed and under appropriate conditions, use of the weevil has produced good results in reducing Eurasian watermilfoil. A nine-year study of nine southeastern Wisconsin lakes suggested that weevil activity might have contributed to Eurasian watermilfoil declines in the lakes (Helsel et al, 1999).

Cost effectiveness and environmental safety are among the advantages to using the weevil rather than traditional herbicides in controlling Eurasian watermilfoil (Christina Brant, EnviroScience, personal communication). Cost advantages include the weevil's low maintenance and long-term effectiveness versus the annual application of an herbicide. In addition, use of the weevil does not have use restrictions that are required with some chemical herbicides. Use of the weevil has a few drawbacks. The most important one to note is that reductions in Eurasian watermilfoil are seen over the course of several years in contrast to the immediate response seen with traditional herbicides. Therefore, lake residents need to be patient. Additionally, the weevils require natural shorelines for over-wintering.

The Indiana Department of Natural Resources released *E. lecontei* weevils in three Indiana lakes to evaluate the effectiveness of utilizing the weevils to control Eurasian watermilfoil in Indiana lakes. The results of this study were inconclusive (Scribailo and Alix, 2003), and the IDNR considers the use of the weevils on Indiana lakes an unproven technique and only experimental (Rich, 2005). If future infestation of Eurasian watermilfoil should occur, Pretty Lake residents should take the lack of proven usefulness in Indiana lakes into consideration before attempting treatment of the lake's Eurasian watermilfoil with the *E. lecontei* weevils.

**9.7.2 Biological Control of Purple Loosestrife**
Biological control may also be possible for inhibiting the growth and spread of the emergent purple loosestrife. Like Eurasian watermilfoil, purple loosestrife is an aggressive non-native species. Once purple loosestrife becomes established in an area, the species will readily spread and take over the shallow water and moist soil environment, excluding many of the native species which are more valuable to wildlife. Conventional control methods including mowing, herbicide applications, and prescribed burning have been unsuccessful in controlling purple loosestrife.
Some control has been achieved through the use of several insects. A pilot project in Ontario, Canada reported a decrease of 95% of the purple loosestrife population from the pretreatment population (Cornell Cooperative Extension, 1996). Four different insects were utilized to achieve this control. These insects have been identified as natural predators of purple loosestrife in its native habitat. Two of the insects specialize on the leaves, defoliating a plant (*Gallerucella calmariensis* and *G. pusilla*), one specializes on the flower, while one eats the roots of the plant (*Hylobius transversovittatus*). Insect releases in Indiana to date have had mixed results. After six years, the loosestrife of Fish Lake in LaPorte County is showing signs of deterioration.

Like biological control of Eurasian watermilfoil, use of purple loosestrife predators offers a cost-effective means for achieving long-term control of the plant. Complete eradication of the plant cannot be achieved through use of a biological control. Insect (predator) populations will follow the plant (prey) populations. As the population of the plant decreases, so will the population of the insect since their food source is decreasing.

**9.8 Chemical Control**
Herbicides are the most traditional means of controlling aquatic vegetation. No recorded herbicide control occurred within Pretty Lake (Lagrange County) in 2005 or 2006. Herbicides have been used in the past on Pretty Lake. However, it is likely that some residents may have conducted their own spot treatments around piers and swimming areas. It is important for residents to remember that any chemical herbicide treatment program should always be developed with the help of a certified applicator who is familiar with the water chemistry of the target lake. In addition, application of a chemical herbicide may require a permit from the IDNR, depending on the size and location of the treatment area. Information on permit requirements is available from the IDNR Division of Fish and Wildlife or conservation officers.

There are two major disadvantages associated with chemical control of aquatic plants. The primary concern associated with chemical use is user concerns regarding safety. Chemicals undergo rigorous testing prior to licensing. Testing is completed by the USEPA with the final registration occurring within each state. All herbicides are required to result in low toxicity to humans and wildlife and to not persist or bioaccumulate within the environment. Secondarily, users are often concerned due to water use restriction. Restrictions must be posted prior to treatment and can be in the form of irrigation or full body contact. Finally, nutrient releases can occur due to the large volume of dying plant material. This disadvantage can be controlled through correct timing of aquatic plant treatment.

Herbicides vary in their specificity to given plants, method of application, residence time in the water, and the use restrictions for the water during and after treatments. Herbicides occur in two forms: contact and systemic. There are three primary contact herbicides used for controlling submerged aquatic vegetation: diquat (trade name Reward), endothal (trade name Aquathol), and copper-based formulations (trade names Komeen, Clearigate, and Nautique). Contact herbicides are effective for controlling submerged vegetation on the short term. Such herbicides have historically lacked selectivity resulting in the killing non-target plants and sometimes even fish species in a lake. However, recent research suggests that some contact herbicides can be effective for the control of exotic species with relatively minor effects on native species (Skogerboe and Getsinger, 2002). Additionally, it should be noted that the timing and dosage of contact herbicides can improve their selectivity and control. Reward is the typical contact herbicide used for mid-season treatment. Diquat or other copper-based contact herbicides are fast-acting and, based on this; these herbicides are typically used to control nuisance vegetation around docks or in high-use areas. However, plants can recover quickly from treatments of these herbicides; recovery can occur as quickly as four to eight weeks after treatment.

Systemic herbicides are those that work within the system of the plant itself. These herbicides are transported to the root system resulting in killing the entire plant. The three most common systemic herbicides used for the control of Eurasian watermilfoil are flouridone (trade name Sonar or Avast!), 2,4-D (trade name Aqua-Kleen, DMA4, or Navigate), and triclopyr (trade name Renovate). (Additionally, imazapyr, glyphosate, and triclopyr can be used for the control of purple loosestrife.) Flouridone is typically recommended for whole lake treatment of Eurasian watermilfoil and curly-leaf pondweed due to the lower tolerance of these species to flouridone compared with other aquatic plant species. Smith (2002) noted control of Eurasian watermilfoil to the point of limited detectability following whole-lake treatment with flouridone. Additionally, most Eurasian watermilfoil strains have a lower tolerance to flouridone than most other aquatic plant species; therefore, if flouridone is properly applied, control of Eurasian watermilfoil can occur with little harm to native species (AERF, 2005).

Triclopyr and 2,4-D are typically used for spot treatment of small areas of broad-leaf plants (dicots) like coontail, watermilfoil, and waterweed). Treatment with triclopyr is a good option if Eurasian watermilfoil populations are not dense or abundant. Treatment using triclopyr must be aggressive in order to result in adequate Eurasian watermilfoil control. Neither chemical affects monocots such as eel grass or pondweeds and are not effective in the control of curly-leaf pondweed. 2,4-D is a cheaper alternative than triclopyr; however, 2,4-D can impact other native species like coontail.

While providing a short-term fix to the nuisances caused by aquatic vegetation, chemical control is not a lake restoration technique. Herbicide and algaecide treatments do not address the reasons why there is an aquatic plant problem, and treatments need to be repeated each year to obtain the desired control. In addition, some studies have shown that long-term use of copper sulfate (algaecide) has negatively impacted some lake ecosystems. Such impacts include an increase in sediment toxicity, increased tolerance of some algal species, including some blue-green (nuisance) species, to copper sulfate, increased internal cycling of nutrients, and some negative impacts on fish and other members of the food chain (Hanson and Stefan, 1984 cited in Olem and Flock, 1990).

Chemical treatment should be used with caution on Pretty Lake since treated plants are often left to decay in the water. This will contribute nutrients to the lake's water column. Additionally, plants left to decay in the water column will consume oxygen. The in-lake sampling conducted during this study showed that Pretty Lake possessed relatively low nutrient concentrations compared to many Indiana lakes. Nonetheless, as evidenced during the plant survey, the lake's total phosphorus concentration is high enough to support filamentous algae and, based on the water chemistry samples collected during the previous in-lake assessments, the lake may also experience algal blooms. The plankton community present in Pretty Lake further reflects this issue in that the community is dominated by blue-green algae. Furthermore, the blue-green algae that comprised the largest portion of the plankton community have been known to cause taste, odor, and toxicity problems in other lakes. Chemical treatment is likely the best way to control growth and spread of Eurasian watermilfoil in Pretty Lake. Herbicides (and algaecides; chara is an algae) that are non-specific or require whole lake applications to work are generally not recommended for treatment in Pretty Lake.

### 9.9 Preventive Measures

Preventive measures are necessary to curb the spread of nuisance aquatic vegetation. Although milfoil is thought to 'hitchhike' on the feet and feathers of waterfowl as they move from infected to uninfected waters, the greatest threat of spreading this invasive plant is humans. Plant fragments snag on boat motors and trailers as boats are hauled out of lakes (Figure 19). Milfoil, for example, can survive for up to a week in this state; it can then infect a milfoil-free lake when the boat and trailer are launched next. It is important to educate boaters to clean their boats and trailers of all plant fragments each time they retrieve them from a lake. The Stop Aquatic Hitchhikers! campaign offers information on the prevention of spreading exotic invasive species. Visit their website at for more information: www.protectyourwaters.net

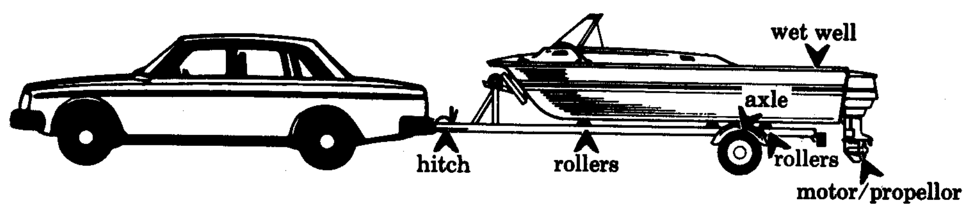



**Figure 19. Locations where aquatic plants are often found on boats and trailers.**

Educational programs are effective ways to manage and prevent the spread of aquatic nuisance species (ANS) such as Eurasian watermilfoil, zebra mussels, and others. Of particular help are signs at boat launch ramps asking boaters to check their boats and trailers both before launching and after retrieval. All plants should be removed and disposed of in refuse containers where they cannot make their way back into the lake. The Illinois-Indiana Sea Grant Program has examples of boat ramp signs and other educational materials that can be used at Pretty Lake. Eurasian watermilfoil is present in Pretty Lake and other area lakes; therefore, educational programs and lake signage will help prevent the spread of this nuisance species into other parts of the lake or into other area lakes. This is particularly important given the popularity of Pretty Lake. Non-resident anglers and other visitors will use their boats in other lakes in addition to Pretty Lake, potentially spreading Eurasian watermilfoil to uninfested lakes. Signs addressing any best management practices to prevent the spread of nuisance aquatic species will ultimately help protect all lakes as new nuisance (often non-native) species are finding their way to Indiana lakes all the time.

## 10.0 Public Involvement

The LARE biologist, district fisheries biologist, association representative, and JFNew representatives met November 9, 2007 to discuss the 2007 aquatic plant treatment and identify aquatic plant treatment options for 2008. JFNew biologists identified nearly 16 acres of Eurasian watermilfoil and 5 acres of curly-leaf pondweed that are recommended for treatment in 2008. However, the PLCC board representative indicated that based on past knowledge of the aquatic plant community and their prioritization to limit nutrient inputs to the lake prior to addressing aquatic plant issues, the PLCC will forego treating exotic plants within Pretty Lake at this time. Over the next few seasons, the PLCC will continue to monitor change in the aquatic plant community and will pursue exotic species control if either Eurasian watermilfoil or curly-leaf pondweed populations double in their coverage of the lake. Therefore, treatment sponsored by the PLCC will be considered if Eurasian watermilfoil covers 30 acres or more than 15% of the lake's surface area or if curly-leaf pondweed covers more than 10 acres or more than 5% of the lake's surface area.

The public meeting for the aquatic plant management plan occurred on September 1, 2007. During this meeting, the aquatic plant management program and specifics regarding the plant surveys and results were discussed. Results from the surveys and from the user survey were discussed. Additionally, the outline of future activities associated with aquatic plant treatment within Pretty Lake were laid out. A majority of attendants representing Pretty Lake indicated that aquatic plant control in the future was both necessary and beneficial. Additional details regarding the user survey are included in the **Lake Uses Section**.

## 11.0 Public Education

Future public education efforts associated with the Pretty Lake Aquatic Plant Management Plan follow efforts identified during completion of the Pretty Lake Diagnostic Study (JFNew, 2007). These items are not repeated herein. Rather individuals should refer to the Diagnostic Study for more information (JFNew, 2007).

Additionally, education efforts targeting information about Indiana's newest aquatic species of concern hydrilla, which was identified in Lake Manitou (Fulton County) in 2006. Hydrilla is an extremely aggressive submerged aquatic plant species that looks similar to common elodea. The basic difference is the number of leaves: hydrilla contains five leaves while common elodea only contains three leaves. Appendix D contains more detailed information on hydrilla, its habitat, and its distribution. Efforts to education individuals on the control, spread, and issues associated with this and other exotic species should follow the Stop Aquatic Hitchhikers! Campaign which can be found at www.protectyourwaters.net. At a minimum, the PLCC should post warnings and send information to Pretty Lake residents about this plant.

Finally, the PLCC should inform their members of exotic and invasive species concerns through their newsletter and at regularly scheduled meetings held throughout the summer at their clubhouse, at monthly board meetings, and at summer Pretty Lake community events. The Pretty Lake Conservation Club's website details up-to-date meeting information and can be accessed at www.prettylake.org.

## 12.0 Integrated Management Action Strategy

The focus of the action strategy should be to meet the three goals identified earlier. These are as follows:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

Each goal, along with objectives to meet this goal, is listed below. Following each objective are the actions which should be taken in order to achieve the objective.

### 12.1 Goal 1: Maintain a stable and diverse aquatic plant community.

The focus of the first goal is on the development and maintenance of a stable, diverse aquatic plant community. To meet this goal, the PLCC should focus both on the emergent plant community and on the submerged plant community as both of these combine to create the very rich and diverse aquatic plant community currently present within Pretty Lake.

*Objective 1: Maintain the diversity of the rooted floating and emergent portions of the aquatic plant community.*

Pretty Lake's high rooted plant diversity and high quality plant species should be protected. The typical community displayed in Figure 20 details the density and diversity that is present in the lake. (Figure 5 details locations around the lake where natural and modified natural shoreline is present.) The lake supports excellent rooted plant diversity and this undoubtedly plays a role in supporting its healthy fishery. The density and diversity of the shallow water, emergent plant community prevents shoreline erosion and sediment resuspension; limits the ability for nuisance waterfowl to enter and exit the water onto the shoreline; provides habitat and cover for fish, frogs, birds, and other wildlife; and filters nutrients that enter the lake from the lakeshore. Management techniques that are not species specific, such as contact herbicides or large scale harvesting, should be avoided to ensure the protection of the high quality community. Additionally, Pretty Lake residents may wish to consider re-establishing portions of the emergent plant community that previously existed in the lake. One particular area in which this could occur would be the wide, flat shelf along the southern shoreline of the lake.

**Figure 20. Typical emergent and rooted floating plant community present in Pretty Lake.**

Pretty Lake residents should also take steps to restore the lake's shoreline vegetation. Purple loosestrife and reed canary grass were identified in several locations along Pretty Lake's lakeshore and in adjacent lawns. Both of these species are introduced from Eurasia and spread rapidly through prolific seed production, vegetative growth, and cultivation. Without individual control, both species can spread along the lakeshore inhibiting boat mooring and individual access to the lake. The LARE program does not provide funding for the control of either of these species at this time. Nonetheless, residents should become familiar with these plants and methods for their control. The two easiest ways to control the spread of both species is through hand pulling or digging and the application of herbicides. Removal of these species and restoration of the shoreline would return many of the functions provided by healthy riparian areas. Landowners should replace these plants with native species that provide equal or better quality aesthetics and are more useful to birds, butterflies, and other wildlife as habitat and a food source. Reed canary grass should be replaced with switch grass, Indian grass, or even big blue stem depending on the landowner's desired landscaping. Swamp blazing star, swamp milkweed, cardinal flower, blue-flag iris, or blue lobelia all offer more habitat and aesthetic variety than that offered by purple loosestrife. (Photographs of these species are included under Goal 4.) A mixture of these species will also allow for colorful blooms throughout the growing season.

*Objective 2: Maintain the density and diversity of the submerged portion of the aquatic plant community.*
Pretty Lake's aquatic plant community is extremely diverse. The lake's submerged community contained 27 species at the time of the diagnostic study, 13 of which were pondweeds. This excellent diversity is unique to Pretty Lake and should be maintained. The variety of submerged plant species present in Pretty Lake provides fish cover and habitat for macroinvertebrates, amphibians, and reptiles; filters nutrients; and increases the aesthetic conditions present in Pretty Lake. Lake residents and users should become aware of the quality of their aquatic plant community and should limit the control or removal of the native populations of submerged aquatic plants. Native species should be controlled only in those locations where the density of aquatic plants limits the aesthetic value or negatively impacts lake use. Control of native communities should be limited in shallow areas or around docks; treatment should only occur if there are difficulties in maneuvering boats to and from docks or other shoreline structures.

### 12.2 Goal 2: Reduce negative impacts from exotic and/or invasive species.

The focus of the second goal is on reducing the negative impacts from aquatic exotic or invasive species. This goal can be accomplished by reducing the density and coverage of current populations of exotic and/or invasive species and preventing the introduction of new species and the spread of current species to areas of the lake where exotic, invasive species are currently not present. Goal 2 builds on the objectives detailed in Goal 1 in that efforts to reach Goal 2 will assist the PLCC in reaching Goal 1.

*Objective 1: Reduce the density and abundance of Eurasian watermilfoil.*
Eurasian watermilfoil is present in relatively high density in a few relatively contained locations within Pretty Lake. In order to prevent the continued spread of Eurasian watermilfoil to other locations within the lake, a control program should be enacted. Eurasian watermilfoil reproduces through fragmentation and can rapidly spread to other areas of the lake and can reach nuisance levels. This species can displace native vegetation and has a tendency to form dense canopies that shade out native vegetation. In order to control Eurasian watermilfoil within Pretty Lake, the use of 2,4-D (Navigate) or Renovate for spot treatment of populations is recommended. Up to 16 acres of Eurasian watermilfoil are recommended for treatment. The cost of this treatment ranges between $4,400 and $6,000 if Navigate is used for treatment and between $6,600 and $16,000 for use of Renovate within Pretty Lake. Cost ranges reflect the variability in water depth at each of the small, scattered locations identified for treatment. Additional annual follow-up treatments would likely be necessary to control Eurasian watermilfoil populations within Pretty Lake.

The numbers included above are for information purposes only as the PLCC chose to forego herbicide application to control the density and abundance of Eurasian watermilfoil within Pretty Lake at this time. However, treatment of Eurasian watermilfoil should be considered in the future if the Eurasian watermilfoil population accounts for more than 15% of the aquatic plant community or covers more than 30 acres of the lake. Based on the decision to delay treatment of Eurasian watermilfoil, education is the key activity in controlling the spread of Eurasian watermilfoil within Pretty Lake. In order to aid in the control of Eurasian watermilfoil, lake residents and users should be educated as to their impact on the spread of the plant. Furthermore, boaters should avoid locations identified in Figure 12 so as to minimize the transport of Eurasian watermilfoil around the lake. Eurasian watermilfoil spreads through fragmentation, which allows one small piece of Eurasian watermilfoil to colonize other areas of the lake. It is very important that boaters avoid driving through areas of the lake currently infested with Eurasian watermilfoil as this can chop the plant thereby creating fragments. These fragments can then be carried to other areas on boat propellers or float to other areas of the lake. It is also important the boaters remove all plant fragments from their boat propeller and trailer before traveling from lake to lake. If signs are currently not posted at the boat ramp detailing the need to clean boats and trailers, then signs should be posted warning boats to check their equipment for plant fragments.

*Objective 2: Control curly-leaf pondweed populations.*
Treatment of curly-leaf pondweed through the LARE program has typically been limited to those lakes where infestations cover large percentages of the water's surface area. Curly-leaf pondweed typically senesces during the height of the recreational season, which is one reason that treatment of this species is not always of high priority. However, curly-leaf pondweed can be a nuisance and control should be initiated as part of the long-term strategy to protect and improve the native submerged plant community. Curly-leaf pondweed is currently found in a few limited areas covering approximately 5 acres of Pretty Lake. Aquathol K is recommended for spot treatment of these areas and should occur over several consecutive summers to reduce the growth of the plant and production of turions, which can last for multiple seasons after treatment. As was indicated with regards to Eurasian watermilfoil above, the PLCC chose to forego curly-leaf pondweed control at this time. However, if curly-leaf pondweed populations increase to the point that they account for more than 5% of the plant community or cover more than 10 acres of the lake's surface, then control of curly-leaf pondweed should be initiated. Whether treatment occurs in 2008 or is delayed until curly-leaf pondweed populations are deemed nuisance, the PLCC should educate their residents and lake users regarding the effects of curly-leaf pondweed.

*Objective 3: Prevent the spread of purple loosestrife and reed canary grass.*
Both purple loosestrife and reed canary grass can be detrimental to native shoreline and wetland species. Currently, control of these species is not funded through the LARE program. Nonetheless, if either of these species are present on an individual property, then the species should be removed through hand pulling and removal of the root structure. Removal should occur prior to the plants flowering.

*Objective 4: Educate lake users and shoreline owners about the impacts of exotic and invasive species.*
Currently, Indiana is home to three exotic, invasive species: Eurasian watermilfoil, curly-leaf pondweed, and hydrilla. To date, hydrilla is limited to one lake—Lake Manitou in Rochester, Indiana. In order to prevent the spread of this and other exotic species, lake users should be educated regarding the potential impacts of these species and the threat of their spread. All three species spread by fragmentation allowing them to spread from one area to another within a lake and from lake to lake. Therefore, it is imperative that users remove all plant fragments from boats and trailers when entering and exiting lakes. Posting signs at the boat ramp will help reinforce this effort. The PLCC should include information about hydrilla, Eurasian watermilfoil, and curly-leaf pondweed in their newsletters and on their website. Educational information about these and other exotic species can be found at the Stop Aquatic Hitchhikers! Website (www.protectyourlake.net.).

**12.3 Goal 3: Provide reasonable recreational access while minimizing the negative impacts on plants, fish, and wildlife resources.**
This goal focuses on the control of exotic species for recreational purposes; however, the control of a limited number of native species may also be necessary to meet reasonable recreational access goals. Pretty Lake is primarily a low-impact recreation lake where swimming, fishing, and pleasure

boating are high priority. In order to maintain the high aesthetic and ecological quality for which Pretty Lake is known, it may be necessary to forego some recreational access.

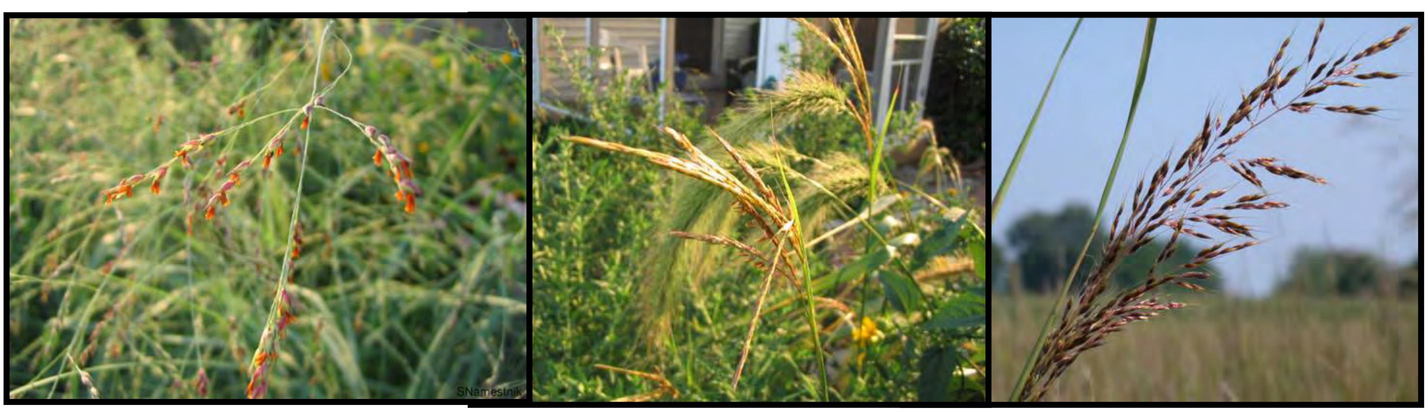
*Objective 1: Allow boat access through the control of aquatic vegetation around boat docks.*
Native species proliferate in many areas of Pretty Lake. If allowed to continue to grow, these plants may begin to restrict shoreline owner access to the lake from their dock. In these areas, hand removal or spot chemical treatment of plants should be implemented. Up to 625 square feet of vegetation can be removed from an individual shoreline without a permit. Removal of aquatic vegetation should be limited in Pretty Lake to only those areas where boat access is necessary. This typically measures 20 to 30 feet. Additionally, aquatic plants should not be treated farther than 100 feet from the lakeshore. No extraneous removal of aquatic vegetation is recommended at this time. If plants are removed from the lake by hand, they should not be left along the shoreline to desiccate. Rather, plants should be removed from the lakeshore and deposited in compost piles, gardens, or bagged for removal. If hand-pulling is not an option, residents should contact a certified aquatic applicator to implement treatment.

**Goal 4: Implement Nutrient Management Reduction Plan**
The following list summarizes the recommendations for maintaining and improving Pretty Lake's chemical, biological, and physical condition. Each of the following recommendations should be implemented and will help maintain Pretty Lake's good water quality. The list is prioritized based on the current ecological conditions of Pretty Lake and its watershed. These conditions may change as land and lake use change requiring a change in the order of prioritization. Watershed stakeholders may also wish to prioritize these management recommendations differently to accommodate specific needs or desired uses of the lake. It is important for watershed stakeholders to know that action need not be taken in this order. Some of the smaller, less expensive recommendations, such as the individual property owner recommendations, may be implemented while funds are being raised to implement some of the larger projects. Many of the larger projects will require feasibility studies to ensure landowner willingness to participate in the project and regulatory approval of the project.

1. Stabilize actively eroding streams (Deal Ditch and a minor drainage on the south side of the lake) by reducing the volume and velocity of water moving through the streams. Consider the installation of sediment traps and check dams in streams where erosion is most severe.

2. Implement individual property owner management techniques. These apply to all watershed property owners rather than simply those who live immediately adjacent to Pretty Lake.
    a. Reduce the frequency and amount of fertilizer and herbicide/pesticide used for lawn care.
    b. Use only phosphorus-free fertilizer. (This means that the middle number on the fertilizer package listing the nutrient ratio, nitrogen:phosphorus:potassium is 0.)
    c. Consider re-landscaping lawn edges, particularly those along the watershed's lakes and streams, to include low profile prairie species that are capable of filtering runoff water better than turf grass.
    d. Consider planting native emergent vegetation along shorelines or in front of existing seawalls to provide fish and invertebrate habitat and dampen wave energy (Figures 21 and 22). Additionally, consider replacing or refacing concrete seawalls with glacial stone seawalls.
    e. Keep organic debris like lawn clippings, leaves, and animal waste out of the water.

f. Examine all drains that lead from roads, driveways, or rooftops to the watershed's lakes and/or streams; consider alternate routes for these drains that would filter pollutants before they reach the water. Stabilize bare drainage ditches with vegetation where possible or rock where flow rates are too high for vegetation.
g. Obey no-wake zones.
h. Clean boat propellers after lake use and refrain from dumping bait buckets into the lake to prevent the spread of exotic species.



4. Monitor and improve erosion control techniques on residential and commercial development sites. Bring areas of concern to the attention of the appropriate authorities such as the Lagrange County SWCD.

5. Connect the properties adjacent to drainage ditches to the existing sewer system. Alternately, construct a wastewater wetland to treat the human waste stream from residences near the lake that are not currently connected to the existing sewer system.

7. Increase usage of the Conservation Reserve Program in the Pretty Lake watershed particularly on land mapped in highly erodible soils.

8. Implement stormwater filtration projects including assessment the number of storm drains adjacent to the lake and determining pollutant loads for each drain and designing and construction a stormwater filter for the gravel road crossing over Deal Ditch at CR 875 East.

The PLCC is currently addressing item 1 through their engineering feasibility study and will likely begin implementation projects following recommendations identified through this feasibility study.

## 13.0 Project Budget

Table 10 contains an **estimated** budget for the aquatic vegetation management action plan for Pretty Lake. As the PLCC has determined not to treat in 2008, treatment costs remain the same through the five year planning period. These and survey costs may change due to increases in chemical costs, changes in plant density within Pretty Lake, or changes in personnel fees. Should the PLCC deem that they should implement treatment, a permit will be necessary for the treatment to occur. Therefore, a permit for this treatment is included in Appendix E. This permit should be submitted by the association and, once a contractor is selected for the treatment, the permit can be completed.

**Table 10. Budget estimate for the action plan, 2007-2011.**

| Task | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| Curly-leaf pondweed treatment | $1,625 | $1,625 | $1,625 | $1,625 | $1,625 |
| Eurasian watermilfoil treatment | $6,000 | $6,000 | $6,000 | $6,000 | $6,000 |
| Plant sampling and plan update | $6,955 | $6,955 | $6,955 | $6,955 | $6,955 |
| **Total** | **$14,580** | **$14,580** | **$14,580** | **$14,580** | **$14,580** |

If treatment of the identified exotic species were to occur within Pretty Lake in 2008, the following budget would be applicable. However, the PLCC chose to prioritize watershed-based projects that target the control of nutrients and sediment at their source as their highest priority. Therefore, the costs below are included for information and guidance purposes only. With no activity, no costs are anticipated to PLCC for aquatic plant control in 2008. If treatment were to occur, it is anticipated to cost as follows:

- Early season curly-leaf pondweed assessment and treatment. Assessment will cost approximately $1,625. Based on the 2007 survey, it is anticipated that 5 acres of curly-leaf pondweed treatment with Aquathol K will be necessary. Final cost estimates will be developed based on the area to be treated and the chemical to be utilized.
- Treatment of approximately 15 acres Eurasian watermilfoil using granular 2,4-D (Navigate) or Renovate. Due to the depth at which the plants are growing and the relatively small and isolated patches of Eurasian watermilfoil, 125-150 pounds per acre would need to be used. At this rate, herbicide application would cost $275-375 per acre for a total cost of $4,400 to $6,000.
- Standard LARE assessment, public meeting, and plan update costs are based on 2007 LARE requirements (pre-treatment exotic species distribution survey; one post-treatment Tier II survey; public meeting; plan update). Assessment costs are estimated to total $1,800, while the meetings and plan update are anticipated to occur at a cost of $5,155 for a total cost of $6,955.

If the PLCC chose to pursue future LARE funding, total fees for the aquatic plant assessment, herbicide application, and plan update are estimated at $14,580 (in 2007 dollars). The PLCC would be required to fund 10% of these costs for a total fee of approximately $1,460. Funding would likely be generated from annual events and local fund-raising efforts by the PLCC. However, as detailed above, treatment and further activity within the LARE aquatic plant management program is not anticipated at this time; therefore, the cost for 2008 aquatic plant community programs is anticipated to be $0. If the PLCC deems it necessary to begin aquatic plant management activities in the future, the above information should serve as a resource or reference for the condition of the aquatic plant community during 2007 and will hopefully allow the PLCC to make educated and informed decisions about any future aquatic plant control efforts.

## 14.0 Monitoring and Plan Update Procedures

At this time, no monitoring or plan updates are anticipated to occur as the PLCC will not continue in the LARE aquatic plant management program at this time. If at a time in the future the PLCC determines that aquatic plant controls are necessary, then the PLCC will be required to update their aquatic plant surveys prior to funding being available from the LARE program. At such a time, both treatment funding and a plan update will be required for further involvement in the LARE aquatic plant management program.

In the meantime, the PLCC should continue to monitor their aquatic plant community and water quality. The District Fisheries Biologist can assist with aquatic plant identification for specific plants about which the PLCC is concerned. Water quality assessment should also continue through the Indiana Clean Lakes Volunteer Monitoring Program. Finally, the aquatic plant community should be reassessed within five years to determine if any changes in density or distribution occurred. Monitoring should follow procedures determined by the LARE program.

If the PLCC determines that treatment is necessary in the future, it is important that all surveys and plan updates conform to LARE requirements. Therefore, any additional monitoring that may occur outside of the LARE program should follow the most current accepted LARE aquatic plant survey guidelines. This could include, but is not limited to early season assessment and treatment for curly-leaf pondweed. As these items are not part of the LARE program, their inclusion in any future LARE aquatic plant management plan updates is not required; however, their inclusion is suggested as a mechanism to contain all pertinent aquatic plant management information in one location and deal with changes in community and treatment requirements at one time even if all actions are not funded through the LARE program.

If individual citizens are interested in pursuing treatment of aquatic plant species, they should consult with the District Fisheries Biologist. This consultation should include discussion of the area in which treatment will occur, the species to be treated, and the chemicals to be used for treatment. If the area measures larger than 625 square feet, then the IDNR requires a permit for the treatment. The LARE program website details contractors that the program has approved to complete aquatic plant treatment. This list is not exhaustive; however, it serves as a good source of initial information. The list can be accessed at the LARE website: www.in.gov/dnr/fishwild/lare.

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# APPENDIX A:

## LAKE USER SURVEY RESULTS

## PRETTY LAKE
## AQUATIC PLANT MANAGEMENT PLAN 2007-2011

## Lake Use Survey

Lake Name: Pretty Lake (2007)

Are you a lake property owner? Yes 94%    No 4%

Are you currently a member of your lake association? Yes 80%    No 11%

How many years have you been at the lake? <2 yrs 6%    2 – 5 yrs 15%    5-10 yrs 15%
> 10 years 61%

How do you use the lake (mark all that apply)
93% Swimming    13% Irrigation
85% Boating    0% Drinking water
70% Fishing    6% Other - Sailing, hunting, rest

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 50%    No 46%

Do you currently participate in a weed control project on the lake? Yes 7%    No 87%

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 43%    No 50%

Does the level of vegetation in the lake affect your property values? Yes 22%    No 65%

Are you in favor of continuing efforts to control vegetation on the lake? Yes 80%    No 13%

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 59%    No 28%

Mark any of these you think are problems on your lake:
20% Too many boats access the lake
11% Use of jet skis on the lake
6% Too much fishing
20% Fish population problem
17% Dredging needed
15% Overuse by nonresidents
43% Too many aquatic plants
4% Not enough aquatic plants
4% Poor water quality
7% Pier/funneling problem

**APPENDIX B:**

**TIER II SURVEY RAW DATA**

**PRETTY LAKE**
**AQUATIC PLANT MANAGEMENT PLAN 2007-2011**

**Spring Tier II survey raw data as collected May 30, 2007**

| DEPTH | FILALG | CERDEM | CHARA | HETDUB | MYREXA | MYRSPI | NAJFLE | NAJGUA | NITELLA | POTAMP | POTCRI | POTGRA | POTILL | POTPEC | POTZOS | VALAME | X_COOR | Y_COOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | | 3 | | | | | | | | | 1 | | 1 | 1 | | 646278.0744 | 4604142.042 |
| 3 | p | | 1 | | | | | | | | | | | 1 | | | 646236.1365 | 4604200.756 |
| 3 | | | 1 | | | | | | | | | 1 | | | | | 646137.498 | 4604226.181 |
| 3 | | 1 | 3 | | | | | | | | | | | | | | 646202.0474 | 4604255.895 |
| 3 | | | 5 | | | | | | | | | | 1 | | | | 646065.4592 | 4604280.474 |
| 3 | | | 1 | | | | | | | | | 1 | | 1 | | 1 | 646023.8639 | 4604308.618 |
| 4 | | 1 | 1 | | | 1 | | | | | | 1 | 1 | | | | 646153.0009 | 4604346.921 |
| 4 | | | 1 | | | | | | | | | | | 1 | | | 646195.9632 | 4604452.691 |
| 4 | | | 3 | | | | | | | | | 1 | | | | | 646107.1381 | 4604529.339 |
| 4 | | 1 | 3 | | | 1 | | | | | | 1 | 1 | | | | 646121.4773 | 4604454.855 |
| 4 | | 1 | 3 | | | | | | | | | | | 1 | | 1 | 645937.938 | 4604457.67 |
| 4 | | | 1 | | | | | | | | | | | 1 | | 1 | 645919.2222 | 4604416.848 |
| 5 | | | 3 | | | | | | | | | | | | | | 645914.7748 | 4604390.064 |
| 5 | | 1 | 3 | | | | | | | | | | | 1 | | | 645862.6081 | 4604428.936 |
| 5 | | | 1 | | | | | | | | | 1 | 1 | 1 | | | 645720.4652 | 4604472.407 |
| 5 | | | 1 | | | | | | | | | 1 | | | | | 645671.0824 | 4604511.556 |
| 6 | | | 1 | | 1 | 1 | | | | | | | | | | | 645633.7036 | 4604479.387 |
| 6 | | | 1 | | | 1 | | | | | | | | 1 | | | 645612.5722 | 4604439.279 |
| 6 | | 1 | 1 | | | | | | | | | | | 1 | 1 | | 645561.0475 | 4604463.471 |
| 6 | | | 1 | 1 | | | | | | | | 1 | | 1 | | 1 | 645544.9655 | 4604347.069 |
| 6 | | | 1 | | | | | | | | | 1 | | | | | 645489.5704 | 4604308.893 |
| 7 | | 1 | 1 | | | | | | | 1 | | | | 1 | | | 645444.8573 | 4604304.482 |
| 7 | | 1 | | | 1 | 1 | | | | | | | 1 | | | 1 | 645501.6941 | 4604258.747 |
| 8 | | 1 | 1 | | | | | | | | | | 1 | 1 | | | 645547.2202 | 4604276.42 |
| 8 | | | | | 1 | | | | | | | | | | 1 | | 645486.8701 | 4604210.697 |
| 8 | | | | | 1 | | | | | | | 1 | | | | | 645525.8899 | 4604192.55 |
| 8 | | | | | | | | | | | | | | | | | 645553.573 | 4604169.393 |
| 9 | | 3 | 1 | | 1 | 5 | | | | | 3 | 1 | | | | | 645580.0942 | 4604121.494 |
| 9 | | 1 | | | | | | 1 | 1 | | | | | | | | 645534.783 | 4604066.733 |
| 9 | | | | | | | | 1 | 1 | | | | | 1 | | | 645619.6241 | 4603973.061 |
| 9 | | | | | | | | | | | 1 | 1 | | | 1 | | 645594.7861 | 4603952.495 |
| 9 | | | 1 | | | | | | | | | | | | 1 | 1 | 645585.7962 | 4603931.522 |
| 10 | | | 1 | | | | | | | | | | | | | | 645654.5586 | 4603959.722 |
| 10 | | | | | | | 1 | | 1 | | | | | | | | 645631.2643 | 4603899.91 |
| 11 | | 1 | | | | | | | | | 1 | | | | 1 | | 645721.2164 | 4603825.984 |
| 12 | | | | | | | | 1 | 1 | | | | | | | | 645802.4602 | 4603832.31 |
| 12 | | | | | | | 1 | | 1 | | | | | | | | 645830.7141 | 4603804.896 |
| 12 | | 1 | 3 | | | 1 | | | | 1 | | | | 1 | | 1 | 645859.6785 | 4603807.644 |
| 13 | | | | | | | | 1 | 1 | | | | | | | | 645872.1336 | 4603830.258 |
| 13 | | | | | | | | 1 | 1 | | | | | | | | 645883.5937 | 4603725.574 |
| 13 | | | 1 | | | | | | | | | | | | | | 645912.2089 | 4603762.701 |
| 13 | | | | | | | | | | | | | | | | | 645919.4103 | 4603799.952 |
| 13 | | | | | | | | | | | | | | | | | 645971.4877 | 4603736.767 |
| 13 | | | | | | | 1 | | 1 | | | | | | | | 645990.4087 | 4603688.36 |

| DEPTH | FILALG | CERDEM | CHARA | HETDUB | MYREXA | MYRSPI | NAJFLE | NAJGUA | NITELLA | POTAMP | POTCRI | POTGRA | POTILL | POTPEC | POTZOS | VALAME | X_COOR | Y_COOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | | | | | | | | | | | | | | | | | 645989.5958 | 4603664.27 |
| 14 | | 1 | 1 | | | | | 1 | 1 | | | | | | | | 645971.9155 | 4603767.767 |
| 14 | | | 1 | | | | | | | | | | | | | | 646109.2322 | 4603793.165 |
| 14 | | | 1 | | | | 1 | | 1 | | | | | | | | 646111.4813 | 4603814.054 |
| 14 | | | | | | | | | | | | | | | | | 646190.9156 | 4603760.369 |
| 14 | | | 1 | | | | 1 | | 3 | | | | 1 | 1 | | | 646327.2266 | 4603770.335 |
| 15 | p | | | | | | | | | | | | | | | | 646359.452 | 4603803.541 |
| 16 | | | | | | | | | 1 | | | | | | | | 646312.0723 | 4603839.335 |
| 16 | | | | | | | | | 1 | | | | | | | | 646308.3331 | 4603871.002 |
| 17 | | | | | | | | | 1 | | | | | | | | 646351.1386 | 4603879.57 |
| 18 | | | | | | | | | 1 | | | | | | | | 646335.2263 | 4603923.906 |
| 18 | | | 1 | | | | | | | | | | | | | | 646361.0518 | 4603964.424 |
| 18 | | | | | | | | | 1 | | | | | | | | 646341.2703 | 4603990.683 |
| 18 | | | | | | | | | | | | | | | | | 646314.6221 | 4603964.808 |
| 19 | | | | | | | | | | | | | | | | | 646351.6398 | 4604053.348 |

**Summer Tier II survey raw data as collected July 30, 2007**

| DEPTH | CERDEM | CHARA | MYREXA | MYRHET | MYRSPI | NAJMAR | NITELLA | POTAMP | POTGRA | POTILL | POTNOD | POTPEC | POTZOS | VALAME | X_COOR | Y_COOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 5 | | | | 1 | | | 1 | | | | | 1 | 646280.4531 | 4604122.106 |
| 2 | | 5 | | | | | | | | | | | | | 646226.1056 | 4604191.234 |
| 2 | | 5 | | | | 1 | | | | 1 | | | | | 646199.8671 | 4604250.117 |
| 3 | | 5 | | | | 1 | | 3 | 3 | 1 | | | | 3 | 646141.8036 | 4604232.202 |
| 3 | | 5 | | | | 3 | | | 1 | | | 1 | | 1 | 646051.5972 | 4604309.027 |
| 3 | | 3 | | | | | | 1 | | | | | | 3 | 646041.7191 | 4604314.87 |
| 3 | | 5 | | | | 1 | | | | | | | | 1 | 646143.5091 | 4604348.232 |
| 3 | | 1 | | | | | | | 1 | | | | | | 646196.1705 | 4604442.011 |
| 3 | | 3 | | | | | | | 1 | 1 | | | | | 646162.1354 | 4604533.788 |
| 4 | 1 | 3 | | | | | | | | 1 | | | | | 646137.8133 | 4604496.827 |
| 4 | | 5 | 1 | | | 1 | | | 1 | | 1 | | | 1 | 645958.6438 | 4604463.484 |
| 4 | | 5 | | | | 1 | | | | 1 | | | | | 645925.4036 | 4604407.439 |
| 4 | | 5 | | | | | | | 1 | 1 | | | | 1 | 645925.326 | 4604409.737 |
| 4 | 1 | 5 | | | | 1 | | | | | | 1 | | | 645834.1953 | 4604456.452 |
| 5 | | 5 | 1 | | 1 | | | | | | | 1 | | | 645728.9962 | 4604438.593 |
| 5 | | 1 | | | 1 | 1 | | | 1 | | | | | | 645673.346 | 4604537.473 |
| 6 | 1 | | 1 | | | | | | 1 | 1 | 1 | 1 | | 1 | 645650.1513 | 4604570.768 |
| 6 | | 5 | | | | 1 | | | 1 | 1 | | | | 1 | 645646.9134 | 4604507.763 |
| 6 | | 3 | | | | 1 | | 1 | 3 | 1 | | 5 | | 1 | 645600.4479 | 4604456.986 |
| 6 | | 5 | | | 1 | | | | 3 | | | 1 | | 1 | 645555.3872 | 4604458.691 |
| 7 | | 5 | | | | 1 | | | 1 | | | | | 1 | 645529.9991 | 4604347.754 |
| 7 | 1 | 3 | | | 1 | | | | | | | | | | 645532.2238 | 4604279.543 |
| 8 | 3 | 5 | 1 | | 1 | | | | | | | | | 1 | 645484.045 | 4604301.629 |
| 9 | 1 | | | | 1 | | | | | | | | | | 645437.8508 | 4604299.324 |
| 9 | | 5 | | | | 1 | | | 1 | | | 1 | | | 645495.8553 | 4604254.929 |
| 9 | | 5 | | | | 3 | | 1 | | 1 | | 1 | | 1 | 645476.3306 | 4604170.661 |
| 10 | 3 | | 1 | | 5 | | | | | | | | | | 645521.4184 | 4604184.663 |
| 10 | 1 | | | | | | | | | | | | | | 645543.4708 | 4604158.427 |
| 10 | | 3 | | | 1 | | | | 1 | 1 | | 5 | | 3 | 645583.0239 | 4604146.443 |
| 11 | | 5 | | | | | | | | | | 3 | | | 645559.4447 | 4604029.456 |
| 11 | | 1 | | | | 3 | | | | | | | 1 | 1 | 645608.9391 | 4603985.869 |
| 11 | 1 | 5 | | | | 1 | | | 1 | | | 1 | | | 645627.9316 | 4603950.61 |
| 12 | | 1 | | | | | | | | 1 | | 3 | | | 645603.4075 | 4603918.538 |
| 12 | 1 | | | | 1 | | | | | | | 1 | | | 645600.2225 | 4603938.086 |
| 13 | 1 | 1 | | | | | | | | | | | | | 645622.0012 | 4603893.488 |
| 15 | | | | | | | | | | | | | | | 645702.223 | 4603831.518 |
| 15 | | | | | | | 3 | | | | | | | | 645794.498 | 4603831.543 |
| 16 | 1 | | | | | | | | | | | | | | 645860.4138 | 4603806.825 |
| 16 | 1 | | | | | 1 | | | | | | | | | 645834.5183 | 4603784.46 |
| 18 | | | | | | | 3 | | | | | | | | 645913.8828 | 4603805.523 |
| 18 | | | | | | | 1 | | | | | | | | 645889.4457 | 4603770.084 |

| DEPTH | CERDEM | CHARA | MYREXA | MYRHET | MYRSPI | NAJMAR | NITELLA | POTAMP | POTGRA | POTILL | POTNOD | POTPEC | POTZOS | VALAME | X_COOR | Y_COOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | | | | | | | | | | | | | 1 | | 645958.7564 | 4603754.625 |
| 18 | 1 | | | | | | 1 | | | | | | | | 645962.9312 | 4603738.074 |
| 19 | | | 1 | 1 | | 1 | | | | | | 1 | | | 645889.2519 | 4603710.305 |
| 19 | | | | | | | | | | | | | | | 645957.9693 | 4603657.236 |
| 19 | 1 | | | | | | 1 | | | | | | | | 645991.6374 | 4603669.412 |
| 20 | | | | | | | 3 | | | | | | | | 646095.1438 | 4603799.656 |
| 20 | | | | | | | 1 | | | | | | | | 646083.9127 | 4603778.594 |
| 20 | | | | | | | | | | | | | | | 646199.1258 | 4603747.988 |
| 20 | | | | | | | 1 | | | | | | | | 646304.1504 | 4603786.066 |
| 20 | | | | | | | 3 | | | | | | | | 646347.7271 | 4603803.718 |
| 22 | | | | | | | 1 | | | | | | | | 646312.6791 | 4603833.079 |
| 22 | | | | | | | 1 | | | | | | | | 646315.2131 | 4603858.937 |
| 23 | | | | | | | 1 | | | | | | | | 646350.3831 | 4603853.65 |
| 24 | | | | | | | 1 | | | | | | | | 646347.779 | 4603918.126 |
| 24 | | | | | | | 1 | | | | | | | | 646305.2858 | 4603943.416 |
| 25 | | | | | | | 3 | | | | | | | | 646326.8134 | 4603990.17 |
| 25 | | | | | | | 3 | | | | | | | | 646356.613 | 4603965.024 |
| 26 | | | | | | | | | | | | | | | 646355.9428 | 4604032.538 |

# APPENDIX C:

# TIER II SURVEY RESULTS

# PRETTY LAKE
# AQUATIC PLANT MANAGEMENT PLAN 2007-2011

**Pretty Lake spring Tier II survey metrics and data as collected May 30, 2007.**

| **Entire Lake (0-20')** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 55.93 | 44.07 | 40.68 | 13.56 | 1.69 | 17.97 |
| *Nitella species* | Nitella species | 27.12 | 72.88 | 25.42 | 1.69 | 0.00 | 6.10 |
| *Stuckenia pectinatus* | Sago pondweed | 27.12 | 72.88 | 27.12 | 0.00 | 0.00 | 5.42 |
| *Ceratophyllum demersum* | Coontail | 23.73 | 76.27 | 22.03 | 1.69 | 0.00 | 5.42 |
| *Potamogeton gramineus* | Grassy pondweed | 22.03 | 77.97 | 22.03 | 0.00 | 0.00 | 4.41 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 11.86 | 88.14 | 10.17 | 0.00 | 1.69 | 3.73 |
| *Valisneria americana* | Eel grass | 11.86 | 88.14 | 11.86 | 0.00 | 0.00 | 2.37 |
| *Potamogeton illinoensis* | Illinois pondweed | 11.86 | 88.14 | 11.86 | 0.00 | 0.00 | 2.37 |
| *Najas guadalupensis* | Southern naiad | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton crispus* | Curly-leaf pondweed | 5.08 | 94.92 | 3.39 | 1.69 | 0.00 | 1.69 |
| *Najas flexilis* | Slender naiad | 8.47 | 91.53 | 8.47 | 0.00 | 0.00 | 1.69 |
| *Myriophyllum exalbescens* | Northern watermilfoil | 8.47 | 91.53 | 8.47 | 0.00 | 0.00 | 1.69 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Heteranthera dubia* | Water star grass | 1.69 | 98.31 | 1.69 | 0.00 | 0.00 | 0.34 |
| *Filamentous algae* | Filamentous Algae | 3.39 | | | | | |

| **0-5' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 100.00 | 0.00 | 50.00 | 43.75 | 6.25 | 42.50 |
| *Potamogeton gramineus* | Grassy pondweed | 50.00 | 50.00 | 50.00 | 0.00 | 0.00 | 10.00 |
| *Stuckenia pectinatus* | Sago pondweed | 50.00 | 50.00 | 50.00 | 0.00 | 0.00 | 10.00 |
| *Ceratophyllum demersum* | Coontail | 31.25 | 68.75 | 31.25 | 0.00 | 0.00 | 6.25 |
| *Potamogeton illinoensis* | Illinois pondweed | 25.00 | 75.00 | 25.00 | 0.00 | 0.00 | 5.00 |
| *Valisneria americana* | Eel grass | 18.75 | 81.25 | 18.75 | 0.00 | 0.00 | 3.75 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 6.25 | 93.75 | 6.25 | 0.00 | 0.00 | 1.25 |
| *Filamentous algae* | Filamentous Algae | 6.25 | | | | | |

| **5-10' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 55.56 | 44.44 | 55.56 | 0.00 | 0.00 | 11.11 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 22.22 | 77.78 | 16.67 | 0.00 | 5.56 | 8.89 |
| *Ceratophyllum demersum* | Coontail | 33.33 | 66.67 | 27.78 | 5.56 | 0.00 | 8.89 |
| *Stuckenia pectinatus* | Sago pondweed | 33.33 | 66.67 | 33.33 | 0.00 | 0.00 | 6.67 |
| *Potamogeton gramineus* | Grassy pondweed | 27.78 | 72.22 | 27.78 | 0.00 | 0.00 | 5.56 |
| *Myriophyllum exalbescens* | Northern watermilfoil | 27.78 | 72.22 | 27.78 | 0.00 | 0.00 | 5.56 |
| *Potamogeton crispus* | Curly-leaf pondweed | 11.11 | 88.89 | 5.56 | 5.56 | 0.00 | 4.44 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 22.22 | 77.78 | 22.22 | 0.00 | 0.00 | 4.44 |
| *Nitella species* | Nitella species | 16.67 | 83.33 | 16.67 | 0.00 | 0.00 | 3.33 |
| *Valisneria americana* | Eel grass | 16.67 | 83.33 | 16.67 | 0.00 | 0.00 | 3.33 |
| *Najas guadalupensis* | Southern naiad | 11.11 | 88.89 | 11.11 | 0.00 | 0.00 | 2.22 |
| *Potamogeton illinoensis* | Illinois pondweed | 11.11 | 88.89 | 11.11 | 0.00 | 0.00 | 2.22 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 5.56 | 94.44 | 5.56 | 0.00 | 0.00 | 1.11 |
| *Najas flexilis* | Slender naiad | 5.56 | 94.44 | 5.56 | 0.00 | 0.00 | 1.11 |
| *Heteranthera dubia* | Water star grass | 5.56 | 94.44 | 5.56 | 0.00 | 0.00 | 1.11 |

| **10-15' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Nitella species* | Nitella species | 47.06 | 52.94 | 41.18 | 5.88 | 0.00 | 11.76 |
| *Chara species* | Chara species | 35.29 | 64.71 | 29.41 | 5.88 | 0.00 | 9.41 |
| *Najas guadalupensis* | Southern naiad | 23.53 | 76.47 | 23.53 | 0.00 | 0.00 | 4.71 |
| *Najas flexilis* | Slender naiad | 23.53 | 76.47 | 23.53 | 0.00 | 0.00 | 4.71 |
| *Ceratophyllum demersum* | Coontail | 17.65 | 82.35 | 17.65 | 0.00 | 0.00 | 3.53 |
| *Stuckenia pectinatus* | Sago pondweed | 11.76 | 88.24 | 11.76 | 0.00 | 0.00 | 2.35 |
| *Potamogeton crispus* | Curly-leaf pondweed | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Valisneria americana* | Eel grass | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Potamogeton illinoensis* | Illinois pondweed | 5.88 | 94.12 | 5.88 | 0.00 | 0.00 | 1.18 |
| *Filamentous algae* | Filamentous Algae | 5.88 | | | | | |

| **15-20' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Nitella species* | Nitella species | 62.50 | 37.50 | 62.50 | 0.00 | 0.00 | 12.50 |
| *Chara species* | Chara species | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |

**Pretty Lake summer Tier II survey metrics and data as collected July 30, 2007.**

| **Entire Lake (0-25')** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 50.85 | 49.15 | 8.47 | 10.17 | 32.20 | 40.00 |
| *Nitella species* | Nitella species | 27.12 | 72.88 | 16.95 | 10.17 | 0.00 | 9.49 |
| *Stuckenia pectinatus* | Sago pondweed | 23.73 | 76.27 | 16.95 | 3.39 | 3.39 | 8.81 |
| *Najas marina* | Spiny naiad | 30.51 | 69.49 | 25.42 | 5.08 | 0.00 | 8.14 |
| *Valisneria americana* | Eel grass | 27.12 | 72.88 | 22.03 | 5.08 | 0.00 | 7.46 |
| *Potamogeton gramineus* | Grassy pondweed | 27.12 | 72.88 | 22.03 | 5.08 | 0.00 | 7.46 |
| *Ceratophyllum demersum* | Coontail | 25.42 | 74.58 | 22.03 | 3.39 | 0.00 | 6.44 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 15.25 | 84.75 | 13.56 | 0.00 | 1.69 | 4.41 |
| *Potamogeton illinoensis* | Illinois pondweed | 20.34 | 79.66 | 20.34 | 0.00 | 0.00 | 4.07 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 6.78 | 93.22 | 5.08 | 1.69 | 0.00 | 2.03 |
| *Myriophyllum exalbescens* | Northern water milfoil | 10.17 | 89.83 | 10.17 | 0.00 | 0.00 | 2.03 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Potamogeton nodosus* | Long-leaf pondweed | 3.39 | 96.61 | 3.39 | 0.00 | 0.00 | 0.68 |
| *Myriophyllum heterophyllum* | Various leaved watermilfoil | 1.69 | 98.31 | 1.69 | 0.00 | 0.00 | 0.34 |

| **0-5' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 100.00 | 0.00 | 12.50 | 18.75 | 68.75 | 82.50 |
| *Valisneria americana* | Eel grass | 43.75 | 56.25 | 31.25 | 12.50 | 0.00 | 13.75 |
| *Najas marina* | Spiny naiad | 56.25 | 43.75 | 50.00 | 6.25 | 0.00 | 13.75 |
| *Potamogeton gramineus* | Grassy pondweed | 50.00 | 50.00 | 43.75 | 6.25 | 0.00 | 12.50 |
| *Potamogeton illinoensis* | Illinois pondweed | 37.50 | 62.50 | 37.50 | 0.00 | 0.00 | 7.50 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 12.50 | 87.50 | 6.25 | 6.25 | 0.00 | 5.00 |
| *Stuckenia pectinatus* | Sago pondweed | 18.75 | 81.25 | 18.75 | 0.00 | 0.00 | 3.75 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Myriophyllum exalbescens* | Northern water milfoil | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Ceratophyllum demersum* | Coontail | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Potamogeton nodosus* | Long-leaf pondweed | 6.25 | 93.75 | 6.25 | 0.00 | 0.00 | 1.25 |

| **5-10' stratum** | | | **Density Scale** | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 69.23 | 30.77 | 0.00 | 23.08 | 46.15 | 60.00 |
| *Stuckenia pectinatus* | Sago pondweed | 46.15 | 53.85 | 30.77 | 0.00 | 15.38 | 21.54 |
| *Potamogeton gramineus* | Grassy pondweed | 53.85 | 46.15 | 38.46 | 15.38 | 0.00 | 16.92 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 46.15 | 53.85 | 38.46 | 0.00 | 7.69 | 15.38 |
| *Ceratophyllum demersum* | Coontail | 46.15 | 53.85 | 30.77 | 15.38 | 0.00 | 15.38 |
| *Valisneria americana* | Eel grass | 61.54 | 38.46 | 53.85 | 7.69 | 0.00 | 15.38 |
| *Najas marina* | Spiny naiad | 38.46 | 61.54 | 30.77 | 7.69 | 0.00 | 10.77 |
| *Potamogeton illinoensis* | Illinois pondweed | 38.46 | 61.54 | 38.46 | 0.00 | 0.00 | 7.69 |
| *Myriophyllum exalbescens* | Northern water milfoil | 23.08 | 76.92 | 23.08 | 0.00 | 0.00 | 4.62 |
| *Potamogeton amplifolius* | Large-leaf pondweed | 15.38 | 84.62 | 15.38 | 0.00 | 0.00 | 3.08 |
| *Potamogeton nodosus* | Long-leaf pondweed | 7.69 | 92.31 | 7.69 | 0.00 | 0.00 | 1.54 |

| **10-15' stratum** | | | Density Scale | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Chara species* | Chara species | 62.50 | 37.50 | 37.50 | 0.00 | 25.00 | 32.50 |
| *Stuckenia pectinatus* | Sago pondweed | 50.00 | 50.00 | 25.00 | 25.00 | 0.00 | 20.00 |
| *Najas marina* | Spiny naiad | 25.00 | 75.00 | 12.50 | 12.50 | 0.00 | 10.00 |
| *Nitella species* | Nitella species | 12.50 | 87.50 | 0.00 | 12.50 | 0.00 | 7.50 |
| *Ceratophyllum demersum* | Coontail | 37.50 | 62.50 | 37.50 | 0.00 | 0.00 | 7.50 |
| *Valisneria americana* | Eel grass | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Potamogeton illinoensis* | Illinois pondweed | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Potamogeton gramineus* | Grassy pondweed | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |
| *Myriophyllum spicatum* | Eurasian watermilfoil | 12.50 | 87.50 | 12.50 | 0.00 | 0.00 | 2.50 |

| **15-20' stratum** | | | Density Scale | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Nitella species* | Nitella species | 57.14 | 42.86 | 35.71 | 21.43 | 0.00 | 20.00 |
| *Ceratophyllum demersum* | Coontail | 28.57 | 71.43 | 28.57 | 0.00 | 0.00 | 5.71 |
| *Najas marina* | Spiny naiad | 14.29 | 85.71 | 14.29 | 0.00 | 0.00 | 2.86 |
| *Potamogeton zosteriformis* | Flat-stem pondweed | 7.14 | 92.86 | 7.14 | 0.00 | 0.00 | 1.43 |
| *Stuckenia pectinatus* | Sago pondweed | 7.14 | 92.86 | 7.14 | 0.00 | 0.00 | 1.43 |
| *Myriophyllum heterophyllum* | Various leaved watermilfoil | 7.14 | 92.86 | 7.14 | 0.00 | 0.00 | 1.43 |
| *Myriophyllum exalbescens* | Northern water milfoil | 7.14 | 92.86 | 7.14 | 0.00 | 0.00 | 1.43 |

| **20-25' stratum** | | | Density Scale | | | | |
|---|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Frequency of Occurrence** | **0** | **1** | **3** | **5** | **Dominance** |
| *Nitella species* | Nitella species | 100.00 | 0.00 | 71.43 | 28.57 | 0.00 | 31.43 |

## APPENDIX D:

## HYRDILLA INFORMATION FOR DISTRIBUTION

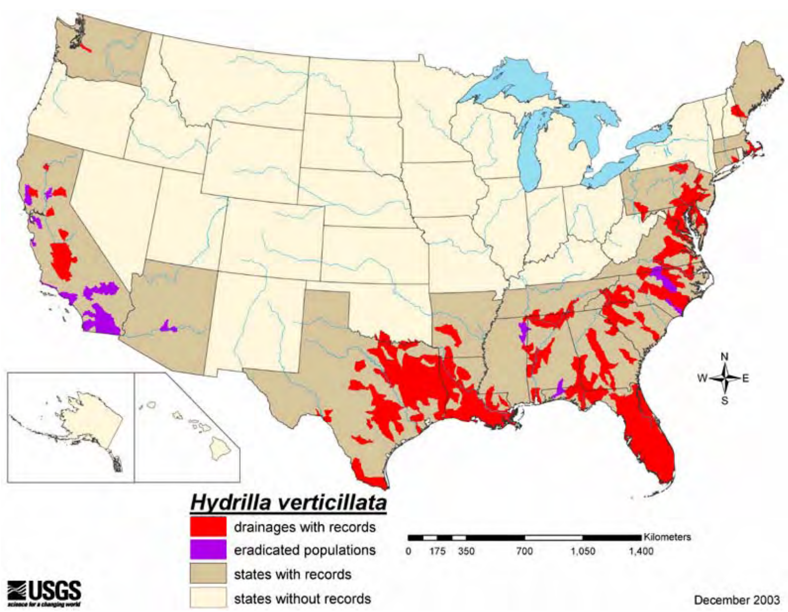
## PRETTY LAKE
## AQUATIC PLANT MANAGEMENT PLAN 2007-2011

# HYDRILLA

**COMMON NAME:** Hydrilla
Hydrilla is also known as water thyme, Florida elodea, Wasserquirl and Indian star-vine.

**SCIENTIFIC NAME:** *Hydrilla verticillata* (L.f.) Royle
Hydrilla's scientific name is made up of the Greek word "hydro" meaning "water" and the Latin word "verticillus" that means "the whorl of a spindle". Appropriately named, it is an aquatic plant with leaves that are whorled around the stem. Hydrilla is in the Frog's Bit family, or Hydrocharitaceae. It is the only species of the genus *Hydrilla* in the world though it resembles many of the other species in the family.

**DISTRIBUTION:** It is not really known where exactly hydrilla originated. Some sources give a broad native range of parts of Asia, Africa and Australia. Other sources are more specific and say that the dioecious form of hydrilla originated from the Indian subcontinent and the monoecious form originated from Korea. Currently the only continent without records of hydrilla is Antarctica.

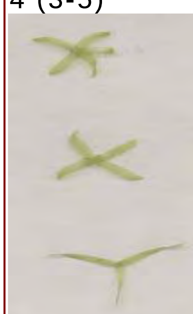


**Indiana:** Hydrilla has not been detected in Indiana waters but it is on our Aquatic Nuisance Species watch list.

**DESCRIPTION:**

**Leaves:** Leaves are small about 2-4 mm wide and 6-20 mm long. They are strap-like with pointed tips and have visible saw-tooth margins. The leaves are whorled around the nodes in groups of 4-8 leaves. The leaf midvein is reddish in color and usually has a row of spines on it. This gives the plant a rough texture. The leaves are usually a green color, though topped out leaves could be bleached by the sun and appear more yellowish. Hydrilla has an axillary leaf scale called a squamula intravaginalis that is found next to the stem at the base of the leaf. This distinguishes it from the other species in the Hydrocharitaceae family. One may confuse hydrilla with another exotic weed, Brazilian elodea (*Egeria densa*). Hydrilla will have rough teeth on the underside of the leaves where Brazilian elodea will not. There is also a native species found in Indiana, American elodea (*Elodea canadensis*), which looks somewhat like hydrilla.

**Identification Characteristics of the Hydrocharataceae**

| **Character** | **Brazilian Elodea** *(Egeria densa)* | **American Elodea** *(Elodea canadensis)* | **Hydrilla (monoecious)** (*Hydrilla verticillata* | **Hydrilla (dioecious)** (*Hydrilla verticillata)* |
|---|---|---|---|---|
| **Leaves per Whorl** | 4 (3-5)  | 3(2)  | 5(2-8)  | 4-5 (2-8)  |
| **Serrated Edges Visible** | With magnification | With magnification | Distinct on older plants | Distinct |
| **Leaf Size** | Up to 4cm | Up to 1.5 cm | 1-2 cm | 1-2 cm |
| **Flowers** | Male only, up to 2 cm | Tiny, male and female on separate plants | Male and female on same plants, to 1 cm | Only female plants in US, to 1 cm |
| **Tubers Present** | No | No | Yes | Yes |

**Roots/Stem:** New root sprouts are white and when growing in highly organic soil they may be become brown. They are submerged and buried in the hydro-soil. Hydrilla stems are very slender only about 1/32 of an inch wide, but they can grow to lengths of 30 feet. When the stem nears the waters surface it branches out considerably. The monoecious form of hydrilla will usually start to branch out at the sediment level rather than at the top of the water.

**Flowers:** The flowers are imperfect (meaning there are separate male and female flowers) but the plant can be monoecious (flowers of both sexes on one plant) or dioecious (flowers of one sex being produced per plant). The female flower is white with three petals that alternate with three whitish sepals. The male flower has petals and sepals similar to the female flower, but the color could be white, reddish, or brown.

**Fruits/Seeds:** Hydrilla produce two different hibernacula to cover its buds. One is called a tuber, which forms terminally on rhizomes. They can be 5-10 mm long and are off white to yellow colored. Hydrilla also produces a turions which are compact dormant buds in the leaf axil. They are 5-8 mm long, dark green in color, and they appear to be spiny. The turion will break off and settle to the bottom of the water to start a new plant. The tubers are able to over winter and re-sprout as new plants as well. Seeds are also produced.

**LIFE CYCLE BIOLOGY:** Hydrilla is a submersed, herbaceous, perennial aquatic plant. It is capable of living in many different freshwater habitats. It will grow in springs, lakes, marshes, ditches, rivers, or anywhere there is a few inches of water. Hydrilla can tolerate low nutrient and high nutrient conditions as well as a salinity of up to 7%. Another adaptation hydrilla possesses, that enable it to out compete native plants, is the ability to grow in low light conditions. It is able to grow at deeper depths and can begin to photosynthesize earlier in the morning than most other aquatic plants. In the beginning stages of life hydrilla elongates at a rate of one inch per day. This continues until the plant comes close to the top of the water, here it begins to branch out. It produces a large mat of vegetation at the waters surface intercepting the light before it can reach other plants.

Hydrilla can reproduce in four different ways, fragmentation, tubers, turions, and seed. Fragmented pieces of hydrilla that contain at least one node are capable of sprouting into a new plant. The tubers of hydrilla are formed on the rhizomes and each one can produce 6,000 new tubers. When out of water a tuber can remain viable for several days, it can even lie dormant for over 4 years in undisturbed soil before sprouting a new plant. Turions are formed in the leaf axils of the plant. They are broken off and once settled in the sediment they can sprout into a new plant. Uncharacteristic of most plants, seed production in hydrilla is of least importance for reproduction. It seems that seed production is mostly used for long distance dispersal by means of ingestion by birds. The monoecious form of hydrilla puts more energy into tuber and turion production than does the dioecious form. It is good to know which form you have to decide on the best management technique.

The main adaptations that give hydrilla an advantage over other native plants are: it can grow at low light intensities, it is better at absorbing carbon dioxide from the water, it is able to store nutrients for later use, it can tolerate a wide range of water quality conditions, and it can propagate in four different ways.

**PATHWAYS/HISTORY:** Under the name Indian star-vine, hydrilla was imported into Florida as an aquarium plant in the 1950's. A farmer living near Tampa acquired the plant but was not impressed with it and threw it out into a canal behind his business. A few months later the farmer noticed that the hydrilla grew very well and decided to market it. By the 1960's severe problems caused by hydrilla were being reported. In 1990 hydrilla could be found in 187 lakes and rivers in Florida. Because there are two different strains of hydrilla found in the United States, the monoecious strain and the dioecious strain, it is believed that there was a separate introduction outside of Florida. The dioecious form is mainly found in the southern states and California and the monoecious form is found north of South Carolina. Hydrilla was brought to national attention in 1980 when it was discovered in the Potomac River in Washington D.C. Currently hydrilla is found in approximately 690 bodies of water within 190 drainage basins of 21 states.

**DISPERSAL/SPREAD:** Once established hydrilla can easily spread to new areas. Fragmented pieces of the plant are able to root and develop into a new plant. These plant fragments are transported to new waters via boats and fishing equipment. Hydrilla's tubers and turions allow it to persist in an area. They can live dormant in the ground and can even resist a drought. Waterfowl are a vector of transport for hydrilla as well. Some waterfowl feed on the plant and may regurgitate the tubers into other bodies of water. It has been found that these tubers are still able to sprout. Birds can also spread seeds. Hydrilla is still sold for aquarium use over the Internet, which could mean expansion of its range through more introductions, accidental or otherwise.

**RISKS/IMPACTS:** Hydrilla is sometimes called an invisible menace because most of the time you don't know it is there until it has filled the water. It will shade out native aquatic plants until they are eliminated. This forms a monoculture, which will reduce biodiversity and alter the ecosystem. Hydrilla does not only pose a threat to other plants but to animals as well. When hydrilla becomes over abundant, fish population imbalances are likely. The dense mats of hydrilla will alter the waters chemistry by raising pH, cause wide oxygen fluctuations, and increase water temperature.

Hydrilla is an economic drain. Millions of dollars are lost due to reduced recreational opportunities as hydrilla mats interfere with boating, swimming, fishing, etc. In flowing waters hydrilla will greatly reduce flow and can cause flooding. For operations that require water intake, hydrilla can pose a problem by clogging the intake pipes. Waterfront property values drop in areas infested with hydrilla. Millions of dollars are annually spent trying to control this aquatic pest.

**MANAGEMENT/PREVENTION:** Control of aquatic weeds is difficult and eradication sometimes can be an unrealistic goal. Before any type of management technique can be implemented there needs to be a positive identification of the plant. Some native plants look similar to hydrilla so it is important to have proper identification.

Hydrilla has not yet appeared in Indiana, however it is not far away. If this plant shows up in Indiana waters, it needs to be eliminated immediately. While there are many methods available to control aquatic plants, the method most suitable for complete and fast elimination is chemical control. Aquatic herbicides containing the active ingredient endothall, fluridone, or diquat are all labeled for use on hydrilla.

For states that have major infestations of this pest plant, they have looked to hydrilla's native range for any insects that could be used as a biological control. Four hydrilla-attacking insects have been released. *Bagous affinis*, a hydrilla tuber-attacking weevil and *Hydrellia pakistanae*, a leaf-mining fly both were released in 1987. *Hydrellia balciunasi* is another leaf mining fly that was released in 1989. *Bagous hydrillae*, a stem-mining weevil, was released in 1991. Many different states have released one or a combination of the four insects. It is still too early to know what long-term impacts these insects will have on hydrilla. One Indiana company is helping to develop a biological control method for hydrilla. SePro Inc. of Carmel, Indiana is a cooperator in a project with U.S. Army Engineer Research and Development Center Environmental Laboratory to grow an endemic fungal pathogen that attacks hydrilla.

Hydrilla has been listed by the U.S. government as a Federal Noxious Weed. With this designation, it is illegal to import or sell the plant in the United States. However, it is likely that internet sales still occur.

Like all invasive species, the key to preventing their spread is knowledge! You can also help by practicing a few good techniques to stop the spread of hydrilla and other aquatic invasive plants.

- ✓ Rinse any mud and/or debris from equipment and wading gear and drain any water from boats before leaving a launch area.

- ✓ Remove all plant fragments from the boat, propeller, and boat trailer. The transportation of plant material on boats, trailers, and in livewells is the main introduction route to new lakes and rivers.

- ✓ Do not release aquarium or water garden plants into the wild, rather seal them in a plastic bag and dispose in the trash.

- ✓ Consider using plants native to Indiana in aquariums and water gardens.

- ✓ If you detect this plant in a lake, pond, or stream, immediately contact the Indiana Department of Natural Resources, Division of Fish and Wildlife.
  - (317)232-4080
  - dkeller@dnr.IN.gov
  - 402 W. Washington St., Rm W273<br>Indianapolis, IN 46204

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PHOTOGRAPHS compliments of the Washington Department of Ecology

Updated 3/05

# APPENDIX E:

# AQUATIC PLANT TREATMENT PERMIT

# PRETTY LAKE
# AQUATIC PLANT MANAGEMENT PLAN 2007-2011

Return to:
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

# APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

| FOR OFFICE USE ONLY |
|---|
| License No. |
| Date Issued |
| Lake County |

*INSTRUCTIONS: Please print or type information*

| | | |
|---|---|---|
| Applicant's Name: Pretty Lake Conservation Club | Lake Assoc. Name: Pretty Lake Conservation Club | |
| Rural Route or Street: 4690 S. 930 E. | | Phone Number: 260-351-3404 |
| City and State: Wolcottville, IN | | ZIP Code: 46795 |
| Certified Applicator (if applicable) | Company or Inc. Name | Certification Number |
| Rural Route or Street | | Phone Number |
| City and State | | ZIP Code |

| | | |
|---|---|---|
| Lake (One application per lake): Pretty | Nearest Town: South Milford | County: Lagrange |
| Does water flow into a water supply | | ☐ Yes ☒ No |

**Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

Treatment Area # 1 LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)

Total acres to be controlled <1 acre | Proposed shoreline treatment length (ft) | Perpendicular distance from shoreline (ft)

Maximum Depth of Treatment (ft) | Expected date(s) of treatment(s) mid to late May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
| Chara | | 30% |
| Nitella | | 10% |
| Sago pondweed | | 10% |
| Coontail | | 10% |
| Grassy pondweed | | 5% |
| Eurasian watermilfoil | x | 5% |
| Eel grass | | 10 |
| Illinois pondweed | | 5 |
| Southern naiad | | 5 |
| Flat-stem pondweed | | 5 |
| Curly-leaf pondweed | x | 5 |
| Filamentous algae | | |
| | | |

| | | |
|---|---|---|
| Treatment Area # | LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP) | |
| Total acres to be controlled | Proposed shoreline treatment length (ft) | Perpendicular distance from shoreline (ft) |
| Maximum Depth of Treatment (ft) | Expected date(s) of treatment(s) mid to late May | |

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

| Aquatic Plant Name | Check if Target Species | Relative Abundance % of Community |
|---|---|---|
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*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

| | |
|---|---|
| Applicant Signature | Date |
| Certified Applicant's Signature | Date |

**FOR OFFICE ONLY**

| | |
|---|---|
| ☐ Approved ☐ Disapproved | Fisheries Staff Specialist |
| ☐ Approved ☐ Disapproved | Environmental Staff Specialist |

Mail check or money order in the amount of $5.00 to:

**DEPARTMENT OF NATURAL RESOURCES**
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204